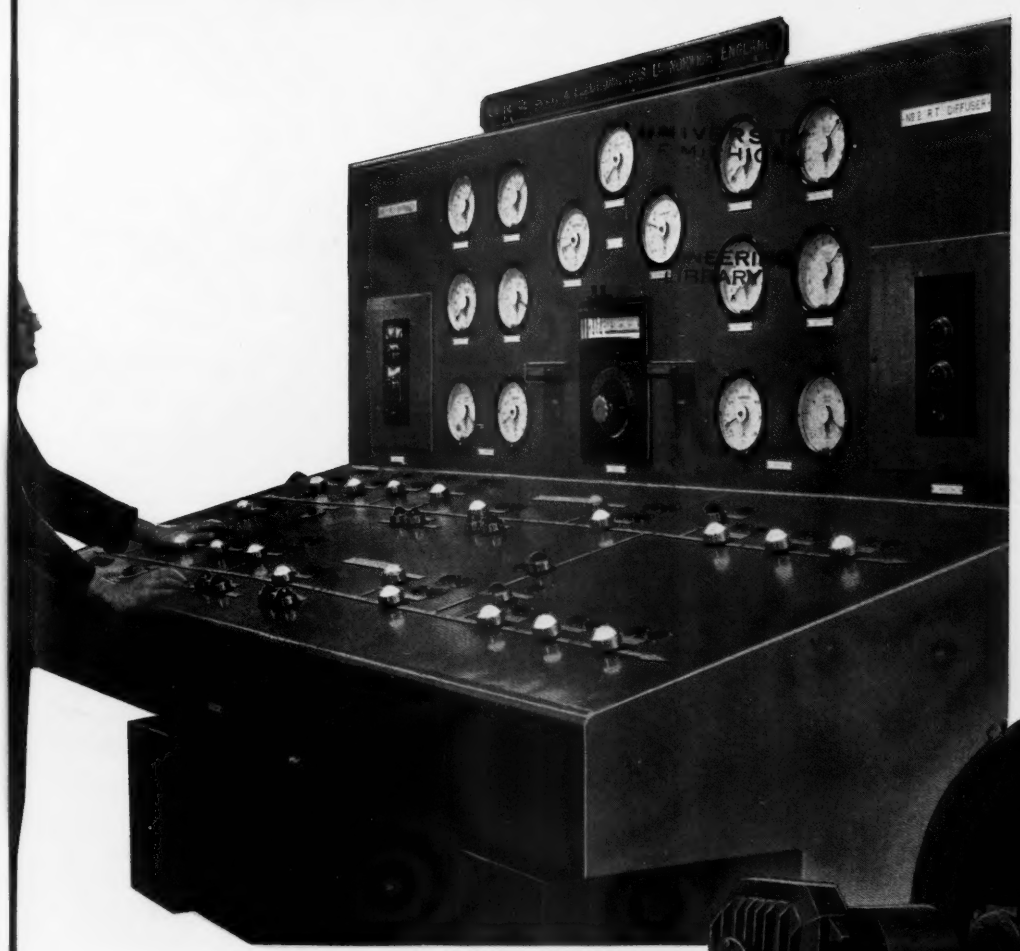
ELECTRICAL REVIEW



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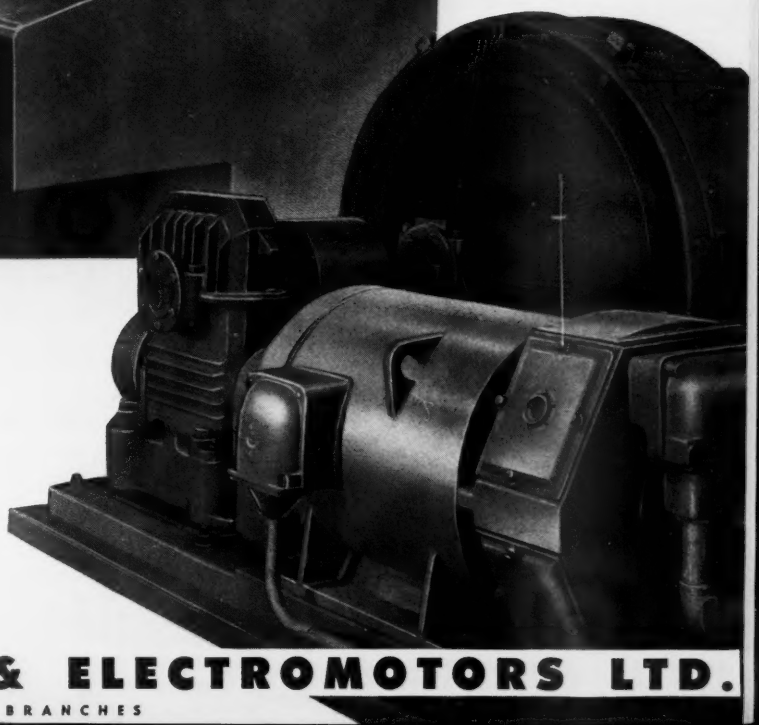

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ELECTRICAL REVIEW

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21 OCTOBER 1955

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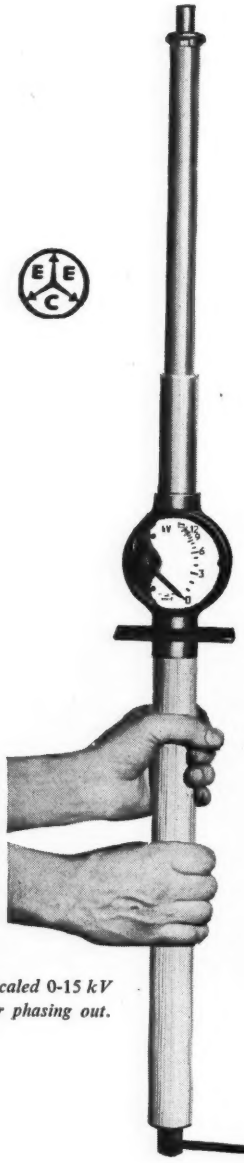

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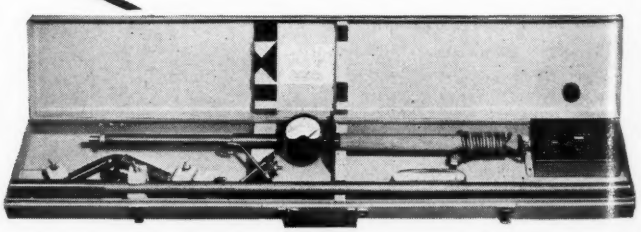

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ELECTRICAL REVIEW

21 October 1955 Vol. 157 No. 17 Established 1872

The Years Ahead

INAUGURAL addresses by presidents and chairmen of technical societies which are a feature of this season of the year, besides surveying branches of knowledge in which the speakers are recognized as authorities, usually have the useful effect of germinating ideas in the minds of their listeners. Both are desirable, especially in electrical engineering in view of its multifold character and of the many new facets that present themselves more rapidly than specialized practitioners can readily assimilate, however necessary it may be for them to keep in close touch with developments in fields akin to their own.

How rapidly these developments have been and are still taking place was indicated by Sir George Nelson in his presidential address to the Institution of Electrical Engineers, which we reported and commented on last week. It was evident that his wide experience has led him to regard the great technical achievements of the past half century as but a prelude to what can be done with increasing momentum in the days to come. The continuing fall in the cost of electricity in relation to the general increase in the cost of living will certainly make a substantial, indeed an essential, contribution towards the aim of doubling our living standards within the next twenty-five years.

Nevertheless something much more than a gradual improvement of past practices is required. While nuclear energy offers a substitute for ordinary fuels, there remains the threat, as Sir George pointed out, of an early exhaustion of natural resources of other materials essential to engineering advance. For these synthetic substitutes will have to be found. The chief limiting factor in attempting to raise our standard (in which ability to maintain Britain's share of export trade is bound up) appears to be in the question of whether enough men of the requisite quality as well as quantity, especially those having the higher technological attainments requisite, can be made available.

This theme is recurrent in most of the chairmen's addresses we have seen. Mr. W. Bamford, whose address to the I.E.E. Measurements and Control Section is summarized in this issue, gave an apt reply to those who, arguing from present trends in industrial productivity, have doubts about the feasibility of reaching the high level referred to within the specified time. He pointed out that this view ignores the technological progress that can reasonably be expected, which includes " labour using " with much better efficiency and accuracy in results (rather than " labour saving ") through electric or electronic automatic control of machinery in its very numerous appropriate applications. The position was summed up by the President, who emphasized that the greatest economic asset possessed by this country, having regard to the paucity of our natural resources, lies in its scientific, technological and skilled people.

ATOMIC POWER

The first positive step in the atomic power plans has been taken by the Central Electricity Authority. It has announced the definite choice of two sites for its first reactor plants after a general hint of their situations; one is at Bradwell on the River Blackwater in Essex and the other at Berkeley, Gloucestershire, on the Severn Estuary. It seems that the Authority has yet to secure the approval of the local planning authorities and the Minister of Fuel and Power but it is hoped that construction will be started in 1957. Although the Authority gives assurances that there will be no injurious emissions from the stations there will probably be local protests but these may be balanced by the consideration that the projects will provide employment in the areas concerned. It is to be hoped that nothing will stand in the way of the work for it is none too soon to prepare to meet the grim coal situation which will arise in the very near future.

MATERIALS HANDLING AND ELECTRICITY

We have often stressed that the development of modern materials handling could not have taken place but for the existence of the electric drive and now, having just seen in advance the film "Mechanical Handling on Show," we are more convinced than ever that this is so. This film has been sponsored by the journal *Mechanical Handling* to provide a pictorial record of some of the main exhibits at the last Mechanical Handling Exhibition in London; the next one is to be held at Earls Court from 9th to 19th May, 1956. It seems to us that every type of equipment featured in the film is that which one would normally find electrically driven in the appropriate factory—certainly in this country and generally abroad. At the preview of the film Mr. C. E. Wallis, chairman, Associated Iliffe Press, Ltd., said that every productivity report so far published had stressed the great part played by modern materials handling in increasing production in every field. Again this supports our earlier contention that there is no single industry in which productivity cannot be increased by the further use of electricity or electrical services and that there is no single class of electrical equipment which cannot in its appropriate field contribute to increasing production.

SCOTLAND'S HERITAGE

In taking as the subject of his presidential address to the Association of Supervising Electrical Engineers that of hydro-electric development in Scotland, and explaining at some length the peculiarities of the terrain, the ideals held and the results achieved by the North of Scotland Hydro-Electric Board, Mr. Bryan Donkin brought home to a yet wider audience the heritage of improvements and facilities, quite apart from those of electricity supply, being provided for the inhabitants of the area. The quarrying industry and the craft of stone-masonry have been encouraged by the use of local stone for the construction of power stations and staff houses. More than 100 miles of roads have been built or rebuilt (often almost the same thing) for general use, opening up spectacular beauties to a much greater public. Fish hatcheries have been set up and extensive areas of fishing acquired by the Board; and at Pitlochry a boating lake of considerable beauty has been formed. Development is now under way to enable use to be made of the vast quantities of peat which lie over Northern areas. If suitable means of winning the peat can be devised, many acres of land may be uncovered for farming and afforestation which are at present of little economic use to the country. In achieving these diverse ends and a total of more than 800 MW of hydro-plant installed or under construction, about 9,500 people were employed last year by the various contractors. The injection of life given indirectly by policies of the Board and directly by the impact of these people, many of them from elsewhere, has had a far-reaching and beneficial effect on the social and economic life of the Highlands and we feel that history will commend the way the Board has gone about its task.

MEETING NEW ZEALAND'S NEEDS

A friendly market which, however, knows what it wants is New Zealand, with whose requirements a New Zealand correspondent deals in this issue. In this the author emphasizes the individuality of the country and the need for British exporters to realize that New Zealand is no longer a colony but a "sovereign nation." Another illusion which has to be dispelled is that goods which satisfactorily meet United Kingdom needs should *ipso facto* suit New Zealand. A proper understanding of these two points is fundamental in trade dealings. New Zealand is a small country but an up-to-date and forward-looking one and over the whole field of trade is our best customer on a *per capita* basis; electrically New Zealand was third in our export list last year but on the same basis was the leading buyer. It does not seem as though New Zealand aims at becoming self-supporting in the electrical way; what British exporters have to contend with is strong competition from North America and Europe. With the preference extended to British goods they are favourably placed but they must not think that orders will come to them naturally.

METAL PRICES

During the last two or three weeks the price of copper which had climbed to about £400 a ton has receded appreciably but it still remains very expensive. The Board of Trade index gives the September figure for copper as 322·3 (30th June, 1949=100) against 218·5 a year earlier. In comparison lead is still cheap, the index figure for September being only 134·7; it was 126·1 in September, 1954. The figure for ingot aluminium (190·0) compares with 173·3 a year ago. Iron and steel are given an index figure of 152·2 (against 142·6) and the figure for "products of blast furnaces and iron and steel melting and rolling" is 156·1 (against 142·6). But the rise in copper is entirely overshadowed by the advance made by the price of rubber in the past year. Starting at 203·7 (about twice the 1949 price) in September last year it reached 290·2 in February last. Then after falling back to 259·1 in March it shot ahead again until by September it was 422·2. For all materials used in the electrical machinery industry the provisional Board of Trade index figure for September was 193·6, as compared with 161·7 in September last year.

WORLD ELECTRICAL MARKETS

New Zealand's Requirements

Advice to United Kingdom Manufacturers

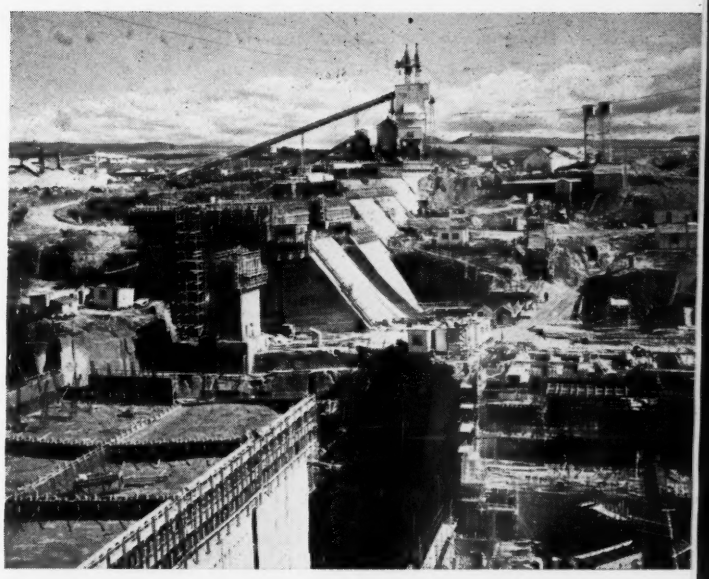
FROM A NEW ZEALAND CORRESPONDENT

IN assessing the importance of New Zealand to United Kingdom manufacturers of electrical plant and equipment prospective exporters may welcome some background to what is considered to be one of the world's most fortunate countries. Although New Zealand is 1,000 miles long and has an area some 10,000 sq miles greater than the combined areas of England, Scotland, Wales and Northern Ireland, it unfortunately, even in this air age, still represents to many people in the Old Country only a small dot on the world map, or an offshoot of Australia. Because of their isolation and other factors New Zealanders tend to be sensitive; for example, potential customers consider the term " Australasia " as long out of date. Some United Kingdom firms and organizations have not yet sufficiently accepted the fact that New Zealand is no longer a colony but an entirely self-governing and independent country.

New Zealand's population, including Maoris, is now just over the two million figure and will be three million by 1975. New Zealand is now only a day and a night's air journey from the west coast of North America and identity of interest in the " Pacific basin " has real meaning to many New Zealanders. There has been significant American " infiltration " in the economic field since the war and some New Zealand establishments are now linked to large consulting, contracting and manufacturing organizations of the United States and Canada. Notable examples of new work either recently undertaken or organized as U.S.A./N.Z. " joint ventures " are the import/export wharf, Auckland; the 5½-mile Rimutaka Tunnel; and the £14 million Kawerau pulp and paper development, although most of the machinery, including electrical equipment, for the Kawerau Mills was supplied by the United Kingdom.

TABLE I.—ELECTRICAL IMPORTS, CALENDAR YEAR 1954

Class of Goods	Value £
Batteries and cells	126,368
Electrodes and carbons	82,892
Generators and magnetos	925,381
Insulated cable and wire	1,645,288
Insulators and parts	128,888
Lamp bulbs	140,659
Lamps (not surgical)	598,157
Motors, etc.	1,255,812
Poles or towers, metal	8,699
Razors, electric	300,352
Telegraph and telephone apparatus	1,215,788
Transformers, convertors	841,785
Radio apparatus, etc.	676,678
Refrigerating units	1,240,413
Washing machines	524,443
Other electrical apparatus	2,768,964



The fourth power development on the Waikato River, the Whakamaru project, is scheduled for initial operation in June next year. The photograph shows the progress of construction on the dam and power house

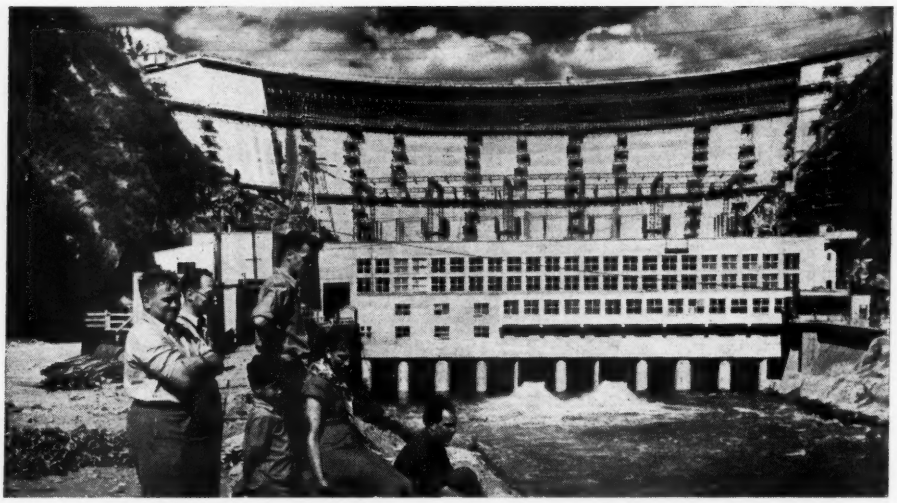
American/New Zealand partnerships will undoubtedly make a very strong bid to supply and build to United Kingdom designs, the £15 million steam power station (180 MW) which the Government recently decided must be installed and operating in 1958.

Backed by subtle " glamour " publicity, American influence has recently become pronounced in the main line railway diesel-electric locomotive field. Sterling convertibility, should it come, would result in increased sales of North American motor vehicles (at present some 10 per cent of the total); and there is of course much electrical equipment in the modern motor vehicle.

Principal Industries

New Zealand's economy is primarily dependent on agriculture. With the notable exception of the paper industry further secondary industries are unlikely to develop on any extensive scale. There are already in existence, however, secondary industries including light engineering, which developed as a result of isolation and the shortages and difficulties arising from two world wars. They received further encouragement from the import licensing protection given by the Labour Government in the period between 1935 and 1949.

The distribution of the New Zealand labour force varies according to the season. In October, 1954, the total labour force was 786,000 and the two principal categories were primary industry with 19 per cent of the total and manufacturing industry with 24 per cent; " notified " male vacancies numbered 27,528. New Zealand has a very serious over-full employment problem due to an " overstretched " economy, aggravated by some of the attitudes engendered by the " welfare state." This problem has recently been reflected in her overseas balance of payments. For the year ended May, 1955, there was a deficit of £39·1 million compared with a surplus of £21·5 million the previous year, largely accounted for by the substantial



Maraetai hydro-electric scheme: a group of mechanical and civil engineers spend their day off in bringing their families to watch the closing of the diversion tunnel and the waters of the Waikato passing through the flumes

increase in "private imports"; £183 million jumped to £240 million during the year.

New Zealand is not yet seriously perturbed about her exports but there is a general appreciation that overseas marketing is now no longer simple. Wool prices continue to be good but meat is moving more slowly and returns from dairy products are lower. In 1954 New Zealand's sales to the United Kingdom totalled £177 million and the United Kingdom exported to New Zealand £126 million. On a *per capita* basis New Zealand is the United Kingdom's best customer.

Imports from the United Kingdom of electrical machinery and appliances together with refrigerator units, washing machines and electric meters totalled £12·5 million in 1954 (see Table 1). The sum of £12·5 million does not include the value of any electrical apparatus which would be part of completely assembled units such as motor vehicles. Imports under broad divisions covering a four-year period are tabulated in Table 2. The import figure may be compared with the total production in New Zealand of electrical machinery, etc., amounting in value to £13·7 million for the year 1953-54. The electrical machinery group embraces the manufacture of machinery, apparatus and supplies for the generation, storage, transmission, transformation and utilization of electrical energy. It includes

TABLE 2.—ELECTRICAL IMPORTS, 1950 TO 1953

Group	Value £(000)			
	1950	1951	1952	1953
Electric Motors and Parts				
United Kingdom	1,040	1,051	1,280	1,087
World Total	1,289	1,232	1,482	1,195
Insulated Cable and Wire				
United Kingdom	1,604	1,525	2,676	2,258
World Total	1,646	1,589	2,923	2,453
Other Electrical Machinery and Equipment				
United Kingdom	4,186	3,959	6,636	5,578
World Total	5,268	5,249	8,349	7,085

TABLE 3.—NEW ZEALAND PRODUCTION OF CERTAIN HOUSEHOLD APPLIANCES*

Appliances	1949-50	1951-52	1952-53	1953-54
Irons	35,797	43,055	59,161	61,295
Radiators	23,675	25,917	32,260	42,107
Vacuum cleaners ...	24,701	32,579	37,128	34,276
Washing machines ...	10,136	28,907	38,804	49,859
Refrigerators	13,689	27,921	36,114	44,693
Electric ranges	21,591	21,623	22,612	25,375
Radio sets	56,356	68,398	56,480	71,689

* These figures have been compiled from production schedules returned annually to the Census and Statistics Department and refer in general to a March year.

domestic and industrial electric ranges, radio assembly and electrical machinery and appliances which cover such items as incandescent and fluorescent lamps, electrical fittings, insulated wires and cables, etc. Production totals of household appliances manufactured in New Zealand during recent years are shown in Table 3.

In recent months the Wellington Press, with some backing from other cities' newspapers, has given extensive publicity to "price rings and monopolies" and reports by the United Kingdom Monopolies and Restrictive Practices Commission. This unfavourable publicity has harmed United Kingdom interests and level pricing if continued may do them much damage. It is openly and frequently stated that if such trade practices affecting certain types of United Kingdom goods exported to New Zealand continue unaltered the customary inclination to buy from the Old Country will not be maintained, and foreign competition will be welcomed.

The Import Licensing Schedule discriminates between the "Scheduled Countries" which are principally the "hard currency" areas and the "Non-Scheduled Countries," in particular the Sterling Area. Import licences are not normally issued for equipment, domestic appliances, etc., which are made in New Zealand, pending reviews of the tariff for each such class of goods; or for dollar plant and equipment when there is a satisfactory alternative product readily available at a competitive price from the United Kingdom or other "soft currency" sources.

The policy of the present New Zealand Government is ultimately to abandon the import licensing system and grant only tariff protection to those local industries functioning economically, on the basis of the advice of the New Zealand Board of Trade, which is conducting a series of inquiries into the tariffs for the various goods affected. New Zealand, on the whole, is not a high tariff country and most classes of electrical machinery from the United Kingdom are admitted free of duty, and with a margin of preference of 20 per cent. For some time past the amount of overseas exchange available to New Zealand importers has been limited by the Reserve Bank but the allocation system was dropped at the end of 1954.

Sales Organization

As New Zealand is a highly competitive "price-conscious" market, very few United Kingdom manufacturers, certainly in the post-war era, have developed any volume of business without adequate local representation.

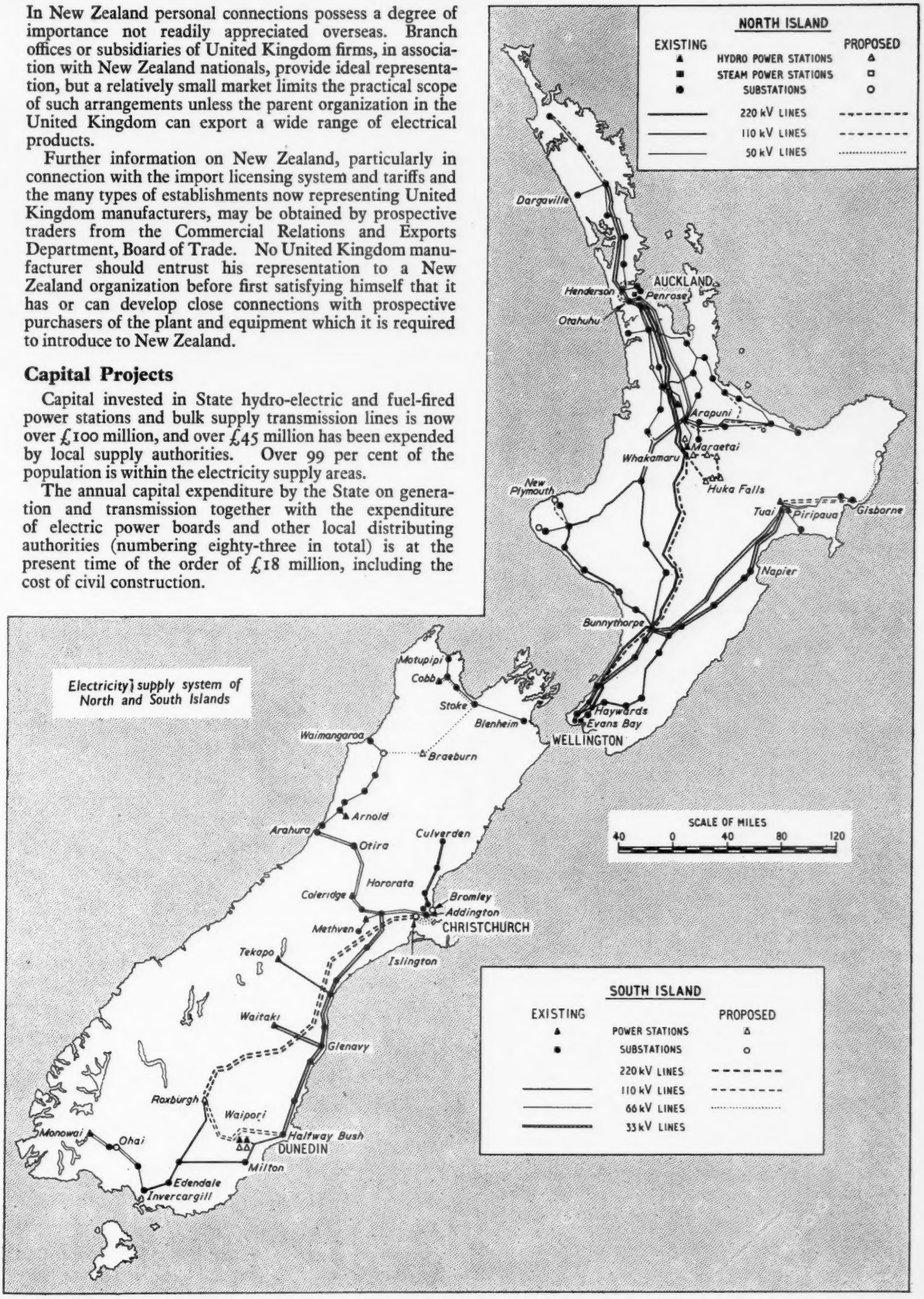
In New Zealand personal connections possess a degree of importance not readily appreciated overseas. Branch offices or subsidiaries of United Kingdom firms, in association with New Zealand nationals, provide ideal representation, but a relatively small market limits the practical scope of such arrangements unless the parent organization in the United Kingdom can export a wide range of electrical products.

Further information on New Zealand, particularly in connection with the import licensing system and tariffs and the many types of establishments now representing United Kingdom manufacturers, may be obtained by prospective traders from the Commercial Relations and Exports Department, Board of Trade. No United Kingdom manufacturer should entrust his representation to a New Zealand organization before first satisfying himself that it has or can develop close connections with prospective purchasers of the plant and equipment which it is required to introduce to New Zealand.

Capital Projects

Capital invested in State hydro-electric and fuel-fired power stations and bulk supply transmission lines is now over £100 million, and over £45 million has been expended by local supply authorities. Over 99 per cent of the population is within the electricity supply areas.

The annual capital expenditure by the State on generation and transmission together with the expenditure of electric power boards and other local distributing authorities (numbering eighty-three in total) is at the present time of the order of £18 million, including the cost of civil construction.



The accompanying pictorial representation of the Waikato River Valley along with the maps of the North and South Island bulk supply transmission lines, power stations and substations existing and proposed, clearly indicate that hydro power is vital to New Zealand's economy as in past years the United Kingdom economy was founded on coal. To-day's hydro station costs range from £70/kW installed for the South Island's 320 MW Roxburgh station to £120/kW for the smaller stations which remain to be developed in the North Island.

Power-conscious New Zealand engineers are closely following world developments in atomic energy. They are, in addition, very interested in the transmission of bulk power by submarine cables in the hope that an effective integration of the North and South Islands' grid systems can be fully investigated and, if feasible, arranged before 1965. The demand for power is much higher in the North Island but the hydro potential is five times greater in the South Island.

Including the geothermal steam station (40/80 MW) at Wairakei and the orthodox 180 MW steam station on the Waikato coalfields the Government has now under construction, or has recently approved or planned, the building of power stations of installed capacity totalling 877 MW. Despite this considerable programme it is felt there will be varying degrees of restriction in electricity supply over the next seven years unless "extraordinary steps" are taken to expedite the rate of construction. The position beyond 1962-63 is still obscure.

The supply of plant and equipment for the 877 MW and future programmes, together with the requirements of local electricity distributing authorities, should be of great interest to United Kingdom manufacturers. Competition must be expected from North America, Sweden, Switzerland, France, Western Germany and Italy* while Australia is also Britain's competitor in some instances. New Zealand itself has designed, fabricated and supplied, in seven years, over 31,000 tons of transmission line tower steel work.

Electrified Railways

Railway electrification, some 127 single-track miles, in the Wellington area is now nearly complete. Auckland, the largest city in New Zealand, lags behind and its electrification plans have been pigeon-holed for the time being. Local engineering advisers maintain that this city's traffic problem requires an elaborate and very costly road system and Auckland, in this respect, should be compared with American cities rather than Continental and English centres.

Comprehensive railway electrification reports on Auckland, Wellington, Christchurch and Dunedin suburban schemes and North Island main trunk electrification date back to 1925. Messrs. Merz & McLellan recently reported on Auckland suburban electrification as well as the main trunk section from Papakura to Frankton but their report has not yet been published. The Sir William Halcrow/Thomas opinion of 1949-50 was to the effect that the electrification of the Auckland suburban railways was an urgent necessity.

Main trunk electrification has been approved by the Labour Government and the present (National) administration, but various factors, including doubt as to the correct system, coupled with the acute lack of engineers and manpower, have delayed final planning and progress. This delay was probably largely responsible for the Government's recent decision to order thirty more main line diesel-electric locomotives from the United States and Canada. United Kingdom locomotives were considered but rejected on the grounds of delivery and price.

In recent years substantial orders have been placed with United Kingdom manufacturers for such items as manual telephones, automatic telephones, private branch exchange equipment and automatic exchange equipment, and a programme costing some £5 million per annum is still under way. Recently, the engineer-in-chief said that they intended to "automatize" the whole of the telephone system. Orders are occasionally placed with the Continent and Australia but the Department awards most of its contracts in Great Britain, provided prices and deliveries are reasonable.

Suiting the Market

In considering this general sketch of New Zealand's electrical market prospective exporters should bear in mind that most public utilities are operated either by the State or local bodies. For most equipment, therefore, other than light factory equipment and domestic appliances, purchasers are officials, bound by regulations, as distinct from employees of private enterprise; the State and local bodies together employ about one in five of the working population.

The United Kingdom Trade Commissioners in New Zealand, in a recent contribution to the United Kingdom *Board of Trade Journal*, said: "New Zealanders are proud of their country and their independence of status and thought. They are very ready to try out new methods or devices and adopt them if they prove more suitable for local conditions. Moreover, the high cost of labour tends to make certain machinery and appliances which economize in labour—such as those developed in North America where similar conditions prevail—more attractive than similar machinery developed to meet the needs of the United Kingdom market." If anything this understates rather than overstates the "purchasing atmosphere" in the electrical field.

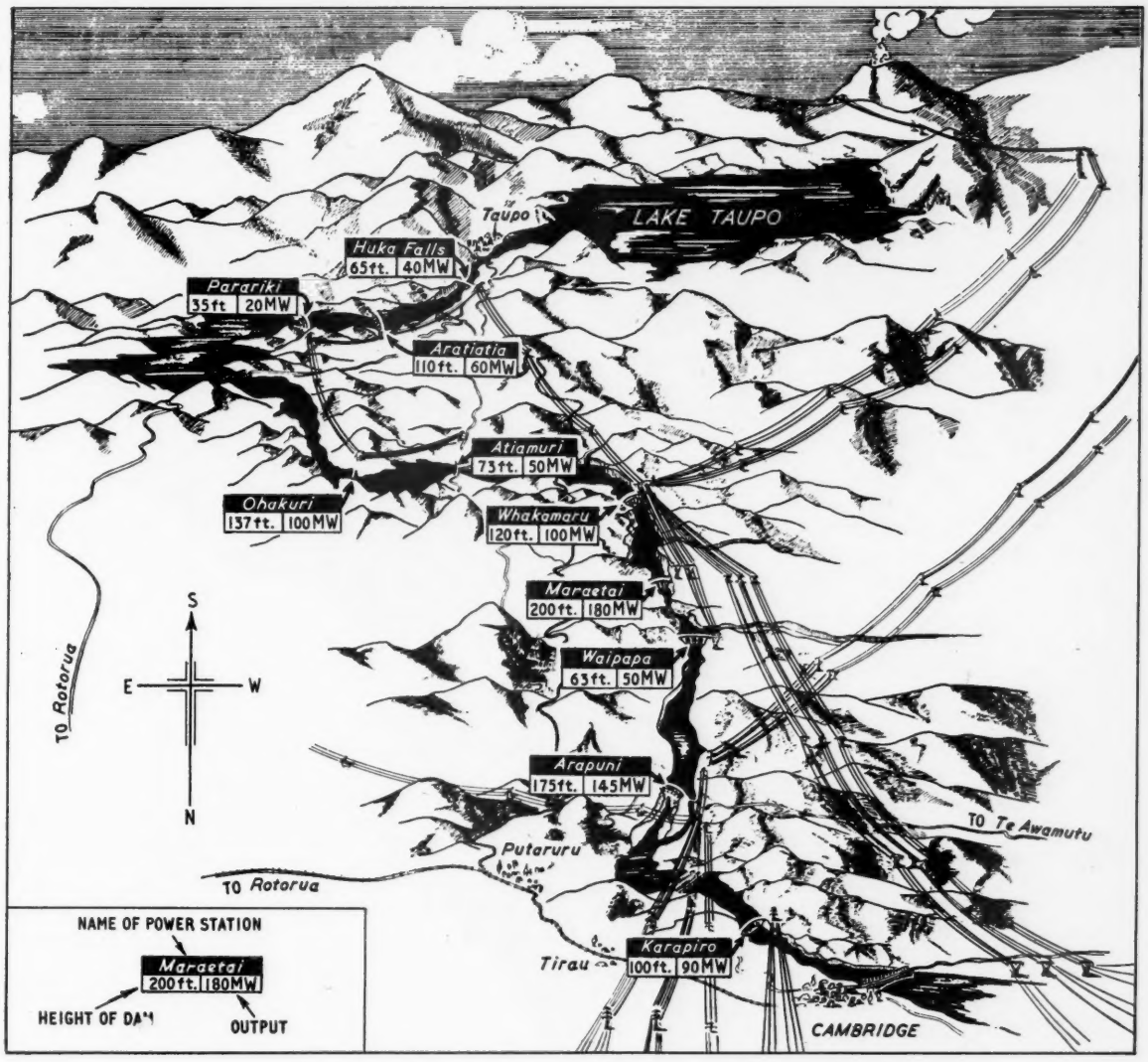
Government and local body employees although always polite and attentive to visiting United Kingdom representatives, particularly of senior status, naturally dislike any suggestion, actual or implied, that New Zealand should automatically accept their views, or that because certain electrical plant or equipment is acceptable in the United Kingdom it must also be suitable for New Zealand. It is regrettable but true that New Zealand purchasers too often find what they consider an inflexible, unadaptable, conservative outlook on the part of United Kingdom electrical manufacturers.

Progressive Sales Policy Needed

Nothing could be more foolish, or more likely to lose orders, than the attitude that because Britain is New Zealand's best customer it is axiomatic that New Zealand should accept British plant and equipment almost irrespective of price, quality, delivery, local service and suitability for conditions which are entirely different from those in the United Kingdom some 12,000 miles away. New Zealanders' orders on the United Kingdom must not be taken for granted; in their isolated community, many purchasers consider their needs to be unique and require constant personal attention. Moreover, half-hearted, impersonal sales efforts, adequate perhaps under sixteen long years of a sellers' and import licensing market, will not counter imaginative and enterprising American and Continental methods.

On the other hand, New Zealand purchasers react to sincere goodwill and a genuine desire on the part of United Kingdom exporters to provide, at a fair price, reliable

* In August two contracts were placed with an Italian concern for h.v. transmission line towers in connection with the Wairakei geothermal power scheme.—Editors, *Electrical Review*.



The Waikato River hydro-electric development (over 1,000,000 h.p.)

electrical plant, equipment and local service all so badly needed in young, developing New Zealand.

In brief, New Zealand is a credit-worthy country, her economic and political stability are unquestioned; she has a rapidly expanding market and opportunity in the electrical field. Moreover, there is an underlying affection for the Old Country but any inertia or tendency to ignore present-day trends will surely dissipate the value of old connections and goodwill. Local manufacture, for strategic and economic reasons, will slowly but inevitably grow, but the greatest immediate challenge to United Kingdom manufacturers undoubtedly lies in foreign manufacturers' increasing interest in New Zealand. This demands a realistic and new approach to a virile independent country's problems and market. It also requires understanding of the strategic treaties which already link the United States and New Zealand and realization that "forbidden fruit tastes sweetest"; much dollar plant and equipment is still all-but-forbidden fruit.

The struggle has begun in earnest in neighbouring Australia; there has already been intensive skirmishing in New Zealand. Foreign competition must be met before it is too late. It can be overcome given true co-operation and a "get together" spirit on the part of all parties interested in the promotion of United Kingdom electrical exports to New Zealand.

Gas-Turbine Blades

METHODS of cooling gas-turbine rotor blades are surveyed in a paper contributed to the proceedings of the Institution of Mechanical Engineers by Dr. H. Cohen (Cambridge University) and Mr. F. J. Bayley (Durham University). The authors suggest that the most attractive is the thermo-syphon system, in which liquids enclosed within each blade convey heat to the more easily cooled root.

Two experimental investigations are described, the first using rotating apparatus to give qualitative indications and the second using a static rig to study heat transfer mechanism. Over a wide range the heat transferred from the heated to the cooled ends of the thermo-syphon was independent of the quantity of coolant. While the best heat-resisting steels and alloys now available can operate with gas temperatures of about 1,200 deg F in long-life machinery, no spectacular advances are considered as likely to be made for some time, if at all.

The Study of Surge Phenomena

Development of a High-Speed, Peak-Reading, Recording Voltmeter

By E. F. HASLER*

IT is generally acknowledged throughout the electricity supply industry, both in this country and abroad, that there may be considerable advantage to be gained from a comprehensive statistical survey of the incidence of surge phenomena, both from lightning and switching, on a representative selection of high-voltage transmission networks. The information which has so far been collected has largely been derived from klydonograph and oscillograph records; these and other systems have previously been discussed by the writer (*Proc. I.E.E.* Pt. II, August, 1951, p. 564). Since that time the instrument to be described has been developed in the Central Electricity Authority's Research Laboratories and a number of them are now being installed at various points on the grid system.

The three most important characteristics of a surge are the wave-shape, the peak voltage and the polarity. The question of wave-shape is a controversial one, since there is some reason to suppose that certain lightning discharges may occasionally possess rise-times of the order of 0·5 μsec. Should such short rise-times in fact occur, most of their danger lies in the excitation of resonances, such as the end turns of inductive windings, and similar phenomena (such as the finite time required for the current to travel down, say, an earthed tower, during which period the top of the tower appears as a radio-frequency transmission line having a characteristic impedance of the order of 300 Ω). Now it is well known that one of the most important effects of surge duration lies in its influence upon the breakdown voltage of insulation: in general, this consists of an increase in dielectric strength for a decrease of surge duration below about 3 μsec. The effect on a dielectric of a surge of duration, say, 1 μsec at a given peak voltage, is therefore comparable to that of a surge of 3 μsec or more at a lower peak voltage. It is therefore possible, by the introduction of suitable weighting, to translate the major effects of wave-shape, for purposes of measurement, into peak voltage.

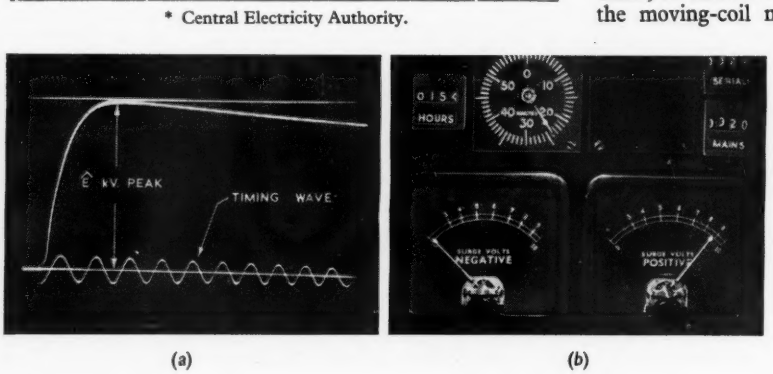
The recording surge voltmeter has accordingly been designed to measure the peak voltage of any surge, with each polarity presented separately as a conventional meter reading, and with the response of the instrument adjusted so that for surges shorter than 3 μsec the actual reading obtained is reduced for a reduction of surge duration. Surges longer than 3 μsec, including switching surges, are given no further weighting. The instrument is intended to operate automatically, resetting itself immediately after recording any surge above a threshold value, and up to 2,000 recordings may be obtained without attention. A photograph of the instrument removed from its case is reproduced in Fig. 1.

Fig. 1.—Recording surge voltmeter removed from case (Nera of England)

Principle of Operation

The principle on which the instrument operates is that of an extension of the surge at its crest value. This is performed in successive stages until a virtual step-function is obtained and this is applied to a moving-coil meter. There are two such measurement channels included in the instrument, one for each polarity of input surge, and both meters are situated on a small panel together with a synchronous minute indicator, hour counter and serial register. Any surge exceeding a predetermined threshold value operates the appropriate surge meter according to polarity and also initiates operation of the recording relay chain, so that after a delay of the order of 0·5 sec (to allow the moving-coil meter to obtain a steady deflection) a

* Central Electricity Authority.



(a) (b)

Fig. 2.—Surge oscillogram and corresponding meter readings

(a) 144 kV peak surge, wave front 1·6 μs, timing wave 1 Mc/s;
(b) Enlargement of 16 mm ciné film showing corresponding surge voltmeter record:

$$\text{Peak voltage} = y \times E \text{ kV r.m.s.} \times k \times a \times b$$
$$= 8{\cdot}8 \times 19 \times \frac{8{\cdot}8}{10} \times \frac{8{\cdot}8}{8{\cdot}8} \times 1$$
$$= 147 \text{ kV peak,}$$

where:—

y = Surge meter reading,

E kV r.m.s. = Phase-earth r.m.s. voltage,

$k = \dfrac{\text{Internal calibration (reference)}}{\text{Surge calibration}}$,

$a = \dfrac{\text{Internal calibration (reference)}}{\text{Internal calibration (recorded)}}$,

$b = \dfrac{\text{1 volt r.m.s.}}{\text{Front panel meter reading V r.m.s.}}$

16 mm ciné camera takes a single photograph of the surge meter panel. A copy of such a recording obtained by the instrument, together with an oscillogram of the surge producing it, is shown in Fig. 2. Once the photograph has been taken the camera is advanced automatically, the meters are returned to zero and the recording relay chain is reset in readiness for any subsequent surge which may appear. The whole operation, including recovery time, occupies approximately five seconds.

In common with almost all methods of surge measurement which have so far been used, an external divider, usually of a capacitive nature and connected from one phase of the transmission line to earth, is required for the operation of this instrument. Since the surge voltmeter has been designed to record surges of both switching and lightning types, the divider should not have any resonance below several megacycles to avoid producing incorrect results. By the use of condensers having a very low value of residual inductance, particularly for the ballast condenser, and careful arrangement of connections, this can be achieved without undue difficulty.

A television type coaxial feeder, correctly matched to prevent reflection of the wave front, is employed to connect the divider to the instrument, which may therefore be situated at a considerable distance dependent upon the details of the divider and of the feeder type employed.

Measurement Ranges

The value of the power-frequency voltage appearing at the divider tap may lie anywhere between 2 and 30 V r.m.s., since a sub-divider is incorporated in the instrument to adjust its sensitivity to the precise level required. This is normally based on an a.c. level of 1 V r.m.s. as read on the front panel of the instrument and the surge meters then read from 3 V to 10 V peak. Since the divider is ideally independent of frequency this means that a surge of, say, 5 V recorded from a 132 kV transmission line represents a peak surge value on the line of $5 \times \frac{1}{\sqrt{}} \times 132 =$ 380 kV peak; i.e., a peak surge value of five times the phase-to-earth r.m.s. voltage figure. By adjusting the sensitivity of the instrument other ranges of measurement can be obtained, e.g., substituting a basis of 1·5 V r.m.s. for 1 V on the front panel indicator the surge measurement range is reduced from 3-10 V, to 2-6·7 V.

In order to present a very high impedance at the input of the instrument the first stage consists of a cathode follower, the output of which can be switched to the front panel meter for the purpose of measuring the normal power frequency voltage appearing on the line. An internal calibrator is also incorporated at this point to facilitate testing and setting-up procedures. Since the value of surge voltage, which is required for statistical purposes with particular reference to lightning investigations, is that of the surge alone without regard to the particular portion of the power-frequency cycle at which it occurs, a 50 c/s rejector filter is incorporated at this point. The surge waveform from which the power frequency has now been removed is applied to a phase-splitter stage, and the two outputs are taken each to one of the two measurement channels, both of which are identical and each of which will respond only to positive polarities of surge. Thus a positive polarity of input surge will cause one measurement channel to operate while a negative polarity input surge will only operate the other channel. Each measurement channel consists basically of a condenser which is charged through a rectifier to the peak value of the surge. A low impedance source is provided by means of a cathode follower so that the time-constant of the condenser is short in the charging direction and very long in the discharge. This process is repeated, employing a larger condenser in each succeeding stage, until a discharge time-constant is obtained of the order of ten seconds. Once a surge exceeding the threshold value has been received the operation of a high-speed relay is arranged to increase this discharge time-constant to over a hundred seconds, so that during the period occupied by the recording process the error due to partial discharge of this final stage condenser is negligible. After the recording operation has been carried out this time-constant is reduced to speed up the recovery of the instrument.

For simplicity of maintenance each of the main sections of the circuit is built on a separate sub-chassis which may be readily replaced, in the event of a component failure, by a fresh unit of the appropriate pattern. This is illustrated in Fig. 3, which shows how the instrument is divided into sub-chassis.

In order to guard against supply failure, the instrument has been arranged for two independent 230 V a.c. supplies,

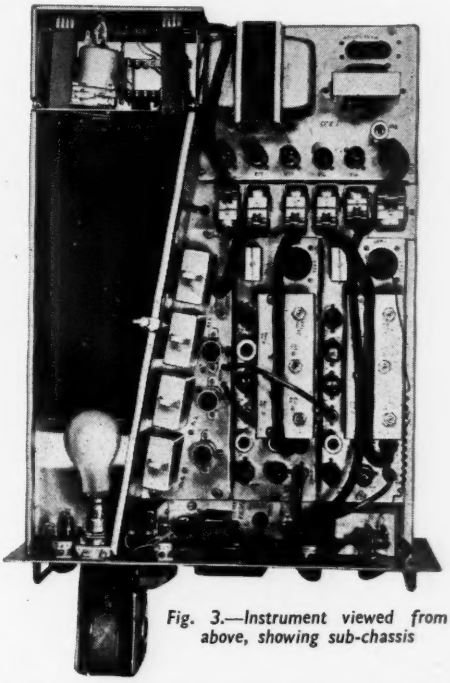


Fig. 3.—Instrument viewed from above, showing sub-chassis

with a changeover relay to perform the selection automatically. The power consumption of the instrument is 90 VA, rising to about 250 VA during an actual recording. The major part of the increase is due to the current taken by the photographic lamp. The surge voltmeter is normally supplied complete in its own case and the overall dimensions are 21in wide, 12½in high, 30in deep, weight 90 lb. The instrument is constructed with a standard 19in front panel in order that it may, if necessary, be mounted in a P.O. rack.

The accuracy of the instrument is ±5 per cent for a surge duration of about 3 μsec or more and of peak voltage from 3 to 10 times the phase/earth r.m.s. figure. A very high percentage of negative feedback is applied. This minimizes the effect of any change of valve characteristics, giving high stability, and it also reduces the indication of the approach of the end of the life of a valve and a number of test points have therefore been provided. The filament of the photographic lamp is continuously monitored by a small pilot lamp except when it is energized for a recording. The pilot lamp is therefore an indication of the

continuity of the filament. For each recording the lamp is energized for less than 1 second and hence, to complete a nominal burning life of 20 hours, more than 70,000 recordings can be made.

A blank plate is mounted adjacent to the "minutes" dial on the surge meter panel. It is intended that at some future date an indicator may be installed in that space to provide, in conjunction with an additional external unit, information concerning the phase or phases affected on a three-phase system. In the meantime, this space may be used for any convenient legend, which it would be of assistance to record (for example, a non-standard divider ratio). One spare set of changeover contacts (rated at 100 mA, 300 V d.c. or a.c. r.m.s. or 1 A, 12 V d.c. for ten million operations) is available and may, if desired, be wired out to operate an external remote indicator. During operation the instrument is inspected daily and entries are made in the log book of instrument time against true time and of the various counter readings, to check whether any recordings have been made. This can readily be carried out by unskilled staff who need only note, in addition, any unusual circumstances such as pilot lamps extinguished or surge meters off zero. Routine maintenance is carried out at intervals of approximately four weeks, although on a system where a large number of surges are experienced it may be advisable to shorten this period or to arrange for more frequent reloading of the camera.

The author wishes to express his thanks to Dr. J. S. Forrest, Director of the Central Electricity Research Laboratories, for permission to publish this article.

Radio-Relay Systems

IN his chairman's address to the Radio and Telecommunication Section of the Institution of Electrical Engineers on 19th October, Mr. H. Stanesby discussed the association of radio-relay systems, as used for television and multi-channel telephony, with line systems.

After summarizing the historical background of line systems he referred to the development of carrier systems having speech sidebands placed side by side in the frequency spectrum so as to provide a number of telephone channels over the same pair of conductors. This technique, he said, was now known as frequency-division-multiplex (FIM), to which his remarks were mainly confined, to distinguish it from time-division-multiplex (TIM) in which the transmission path between the two terminals of a link was repeatedly connected in succession to a number of channels at a supersonic rate.

The FIM telephone system had been developed to provide up to 60 channels per pair over cables containing 24 or more balanced pairs and up to 60 channels per pair over cables containing several coaxial pairs at frequencies of 3,000 kc/s or more. The three principal problems raised related to the assembly and separation of the channels at the two ends, the interconnection of similar and dissimilar systems and the avoidance of interference between channels.

In the first of these, processes that demanded high selectivity were carried out at fixed frequencies and the signals were translated to transmission frequencies in another operation. The interconnection of multi-channel systems was best done by transferring channels in groups or as a whole without frequency translation, which called for international arrangements.

Interference and noise due to intermodulation could be reduced by using highly linear negative-feedback amplifiers in the main transmission path or by confining frequency-translation processes to blocks of channels lying within a two to one frequency ratio and translating at low signal levels.

Television signals, when transmitted for long distances by line, were almost always carried by coaxial cables, but because coaxial pairs were susceptible to cross-talk and noise below 60 kc/s, the signal had to be raised somewhat in frequency and became liable to non-linear distortion.

Contemporary developments started in 1940 from radar techniques in the frequency ranges of 300-3,000 and 3,000-30,000 Mc/s, which permitted employment of broad-band systems with highly directional aerials and the free propagation of signals over line-of-sight paths. In discussing the basic characteristics of broad-band radio-relay systems the chairman pointed out that the higher the frequency, the easier it was to obtain high aerial gains and adequate obstacle clearance, but meteorological conditions were the more likely to affect propagation. In the U.K. radio-relay systems had so far been confined to 1,700-2,300 and 3,300-4,200 Mc/s bands, but work was being done on others.

In the generation and amplification of oscillations at these high frequencies grounded-grid triode valves could be used, but these called for special design features and the gain per stage was low. The alternative was to employ the principle of velocity modulation, in which electron-transit time was an essential and not an undesirable factor.

The final section of the address dealt with the work of the C.C.I.R. (the international body), which was in agreement about preferred radio-frequency patterns for an assembly of large capacity broad-band channels and on wave polarization and frequency deviation as they affected radio-frequency interconnections. While the time might not be ripe for final standards for equipment, Mr. Stanesby expressed his belief that it was already desirable to adopt a limited number of preferred characteristics which could, if necessary, be revised and extended later.

A.C. Switchgear

FOR the subject of his address as chairman of the London Students' Section of the Institution of Electrical Engineers, Mr. M. H. F. Collins took a.c. switchgear. His first point was its influence on the choice of system voltage, which if not high enough made switchgear and cables unduly expensive. The short-circuit rating in MVA, determined by the size and reactance of generating plant and/or the reactance of incoming feeders, assumed a three-phase fault at the switchgear. Comparison between the prospective fault level and the economic switchgear ratings available at each voltage would indicate whether switching voltage should be raised.

Future requirements and possible extensions should be allowed for when designing the original installation, as it was usually costly to increase the short-circuit rating of existing switchgear and sometimes complete replacement might be necessary. The supply system might be sectionalized on reactors introduced to lower the fault level. The four general groups of switchgear, i.e., outdoor open, indoor open, metal-enclosed and metal-clad, were described in connection with the three principal arrangements of single, double and ring main busbars with the mesh connection as an occasionally adopted fourth.

In Britain the only circuit-breakers in common use were the oil-filled, the free-air and the air-blast. Operating mechanisms were manual, solenoid, spring and pneumatic. Hydraulic operation, as used in America, had not been adopted in Britain to any great extent.

VIEWS on the NEWS

By REFLECTOR

LAST week I made reference to the cut in publicity by the gas and electricity supply industries at the behest of the Minister of Fuel and Power. I said that one of the Gas Boards was continuing to use commercial television but actually there are two—North Thames and South Eastern. Possibly our economic situation is worse than that of France for I see from the French journal *Le Commerce Electro-Domestique* that a campaign to encourage electric water heating is now in progress (1st October to 1st December). It is being carried on by Electricité de France with the aid of the principal organizations of manufacturers, installation contractors and retailers. Posters, cinemas and sound radio (but not television) are being used and the printed matter being circulated includes 1,300,000 *buvards* (blotters?), 500,000 *tracts* and 500,000 *dépliants* (which seem to be folders).

* * *

Before the electrical separation of Scotland from England it was a frequent complaint that " Scottish " electricity was being sent to England. I do not remember any dispute about the cost of the transmission lines. Recently, Provost R. Wotherspoon, of Inverness, contended that the North of Scotland should not be called upon to pay for power lines which were used to send electricity south, i.e. to the South of Scotland. He has been assured by the Hydro-Electric Board that here there is a two-way traffic and during the past dry summer the North has been glad to take steam-generated electricity from the South of Scotland Board. The same held good of the Scotland-England lines of course but rabid Scots nationalists chose to ignore such an inconvenient fact.

* * *

In the *Electrical Review* of 7th October it was reported that the South Eastern Electricity Board had opened a showroom in a Brighton departmental store at which people could not only see the latest domestic electrical equipment but also obtain expert advice and (if they wished) pay their accounts. This was a good move but for me it was rather offset by some observations I made last Saturday. One of the larger stores in the South West London district was running a Household Exhibition and I was disappointed to find it dominated by the South Eastern Gas Board which not only occupied about a third of the available space but had notices advertising its services all over the place. Cooking was given great prominence and gas-electric washing machines were on view. The latter, and displays by a vacuum cleaner company and an electric mixer concern, were the only indications of the part which electricity plays in the modern household.

* * *

I have just had an opportunity of reading the latest report of the National Joint Advisory Council of the Electricity Supply Industry and was much impressed by the wide range of its activities which must entail a great deal of work on the part of all concerned. The terms of reference of the Local Advisory Committees, of which there are 450, cover any matters affecting the progress of local units and the well-being of employees, except wages and conditions of employment. Subjects discussed include fire fighting, scrap drives, film shows, scholarships, relations with consumers, power station performance, works costs, music festivals, national savings and many other facets of the working and social life of employees. It is clear that a great deal is being done to ensure that all grades shall feel that they are not merely " cogs in a wheel." Originally welfare matters were predominant but more recently greater attention has been paid to ways of increasing efficiency.

* * *

Drakelow power station, which is being officially opened this week, was recently visited by members of the Burton Natural History Society who, according to the *Burton Daily Mail*, were " signally honoured in the fact that this was the first party ever to be conducted over the new plant." On reading the note I wondered if there was some misconception about the word " plant " but there was much to interest the visitors. The report goes on to say that

> " Stepping out on to the parapet the visitors had a superb view of Burton and the surrounding district. Some of the older members looked down with nostalgia on what they used to know as Drakelow Park. They thought of the fallow deer, the green velvet footpaths, the avenue of beeches and the blasted oak harbouring the brown owls of the old hall—its site is now marked by a red-bricked hut—and the silvery Trent where they used to row and bathe."

The report also mentions that the party ascended a " spidery " network of stairs leading to the top of the building.

* * *

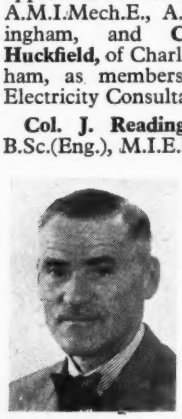
Fifty years ago electric tramways were at the beginning of their heyday and the *Electrical Review* reported conversions of horse-operated systems and the construction of new lines regularly week by week. For instance, the issue of 20th October, 1905, contained notes on the completion of the Bournemouth tramways by the opening of the line to Christchurch; mentioned the forthcoming inauguration of the Belfast system; and reported the starting of two " inner circle " services in Manchester. There were one or two interesting sidelights. The Wilmslow U.D.C. was said to have rejected " on sentimental grounds " a plan for a tramway service between its town and Cheadle; reference was made to " the spoliation of the district, noise, dust and turmoil, and the introduction of trippers." The new tramways at Perth were reported to have been inspected by Mr. Trotter and found to be satisfactory but it was noted that " the T.C. has decided against running cars on Sundays."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Fuel and Power has appointed **Mr. P. McNab Miln,** B.Sc., A.M.I.Mech.E., A.M.I.E.E., of Birmingham, and **Councillor F. E. Huckfield,** of Charlton Kings, Cheltenham, as members of the Midlands Electricity Consultative Council.

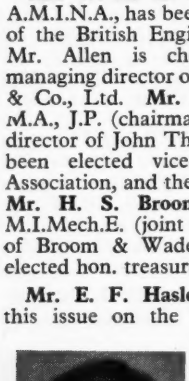
Col. J. Reading, M.B.E., E.R.D., B.Sc.(Eng.), M.I.E.E., has resigned his appointment as assistant engineer-in-chief of the General Post Office, to enter industry. Col. Reading, who was born in 1898 and was educated at the Northampton Polytechnic, London, entered the P.O. Engineering Department in 1926. He had previously been with Messrs. Merz & McLellan and the Radio Research Board. Col. Reading has been an active member of the Institution of Post Office Electrical Engineers; he was secretary from 1935 to 1951 and subsequently chairman of the Council.



Col. J. Reading

Mr. W. K. G. Allen, M.I.Mar.E., A.M.I.N.A., has been elected president of the British Engineers' Association. Mr. Allen is chairman and joint managing director of W. H. Allen, Sons & Co., Ltd. **Mr. E. W. Thompson,** M.A., J.P. (chairman and a managing director of John Thompson, Ltd.), has been elected vice-president of the Association, and the retiring president, **Mr. H. S. Broom,** M.B.E., B.Sc., M.I.Mech.E. (joint managing director of Broom & Wade, Ltd.), has been elected hon. treasurer.

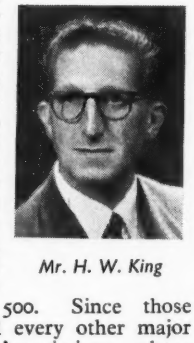
Mr. E. F. Hasler, who writes in this issue on the "Study of Surge Phenomena," was educated at the Stationers' Company's School and then joined the Research Department of British Insulated Callender's Cables, Ltd., at Wood Lane. During the early part of the war he was at Stonebridge Park power station and then joined the R.E.M.E., being engaged in radar maintenance. In 1946 he rejoined B.I.C.C.'s Research Department and worked on the development of electronic surge measuring equipment. In 1950 he joined the British Electricity Authority's Research Laboratories and has been responsible not only for the development of the instrument described in this article, but also for the application of special electronic techniques to a wide variety of problems peculiar to the power industry.



Mr. E. F. Hasler

Mr. J. H. Grey, A.I.A.C., secretary of the Trafalgar Engineering Co., Ltd., has been appointed to the board and will also continue as secretary. **Mr. E. J. Williams,** A.M.I.Mech.E., the general manager, has also been appointed a director; he will continue as general manager. Both gentlemen have also been appointed to serve on the board of the Gothic Engineering Co., Ltd., a subsidiary of the Trafalgar Engineering Co.

At the recent Cliftonville conference of the Purchasing Officers' Association **Mr. H. W. King** was elected president of the Association for 1955 - 56. Mr. King, as national hon. secretary, played a vital part in the Association's reorganization eleven years ago when its fortunes were at a low ebb and its membership was less than 500. Since those days he has held every other major office in the Association, whose membership is now nearly 4,000. He is the purchasing director of Eburite Corrugated Containers, Ltd., which he joined at the age of 20, and he has been in control of its purchasing since 1932, becoming a director in 1948.



Mr. H. W. King

Sir Ivor Cox, managing director of the A.E.I. Overseas Group, was presented last week with the Order of the Southern Cross by the Brazilian Ambassador in London.

Mr. W. R. M. Mitchell, managing director of Mitchell Electric, Ltd., has been elected chairman of the Birmingham Branch of the Incorporated Sales Managers' Association.

The following appointments are announced by the London Electrical Co. (Blackfriars), Ltd.:—

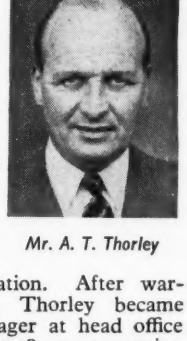
Mr. C. R. Dirs, M.P.O.A., has joined the board. He has been with the company since 1948, first as buyer and latterly as purchasing director. **Mr. A. E. Green** becomes sales director. He joined the company in 1946 and more recently has held the position of sales manager. **Mr. J. D. Johnson** has been appointed general manager. He joined the company in 1950 as departmental manager and more recently has been stock supervisor.

Mr. P. Alliston has been appointed commercial manager of F. Perkins (Canada), Ltd., Toronto, the Canadian company of F. Perkins, Ltd., the British diesel engine manufacturers. Mr. Alliston, who was formerly acting general manager of Perkins' Australian company, leaves Britain on 19th October with his wife and son to take up his new duties.

Mr. B. Raynor informs us that he has relinquished his position as technical representative for British Klockner Switchgear products with Dorman & Smith, Ltd., and is now in the Technical Department of the Rheostatic Co., Ltd.

Mr. M. Wadeson, Nottingham subarea manager of the East Midlands Electricity Board, is president of the Nottingham Society of Engineers for the ensuing year, and he gave his presidential address, on joint consultation in industry, at a meeting of the Society on 10th October.

Mr. A. T. Thorley has been appointed a director of Wilkins & Mitchell, Ltd., Darlaston, South Staffs. Mr. Thorley joined the company in 1934 when he became responsible for "Servis" sales and service development in Lancashire and the North West. In 1938 he became sales manager of the "Servis" organization. After wartime service Mr. Thorley became general sales manager at head office with a period in 1948 spent opening up export business in Belgium.



Mr. A. T. Thorley

Mr. Alexander L. Pullen, Reader in Electrical Engineering and deputy supervisor of research laboratories at University College, London, has been appointed to the newly created Chair of Electrical Engineering at Sheffield University.

The annual dinner and reunion of the **Cromptonian Association** was held at the Café Royal, Regent Street, London, on 30th September, when

more than 200 members and guests attended, Mr. E. C. Holroyde, the president, occupying the chair. Sir Harold Bishop proposed the toast of the Association, to which the president responded. A pair of early Irish glass candlesticks was presented to Mr. H. H. Spencer, M.I.E.E., as a token of appreciation of his services as hon. secretary over the past twenty-one years. Mr. Arthur Parkinson proposed the toast of the guests and Sir John W. Taylor responded. Miss Hazel Crompton, the youngest daughter of the late Colonel R. E. Crompton, and an honorary member of the Association, was also present.

Over 700 of the companies' employees and friends were present at the annual staff dinner of the **Henley Organization** held at the Dorchester Hotel, London, W.1, last Saturday. Sir John Dalton, the chairman, presided and after dinner the toast of

At the Henley staff dinner. Miss J. E. Wright responds to the toast of "The Ladies." On her right is Sir John Dalton, chairman of the Henley Organization

"The Henley Companies" was proposed by Mr. H. Hubbard, who likened the organization to a machine and said that every part of a machine had to be replaced sooner or later and in that fact lay the opportunity for the companies' younger people. Mr. Hubbard welcomed the new directors, Messrs. Meinertzhagen, Vidler and Beaney. In the course of his reply to the toast Sir John Dalton said that telegrams of greeting had been sent from the company present to their overseas colleagues. He was able to announce that a record output had been achieved during the past year. Mr. S. R. Gee wittily proposed the health of "The Ladies" and the response was ably made by Miss J. E. Wright. Following the toasts there was dancing and during the evening there was a cabaret show.

Mr. F. J. Pascoe, the new chairman of Aberdare Cables (Holdings), Ltd., with **Mr. J. P. Gilliver** and **Mr. A. J. Nicholas,** the newly appointed joint

Mr. F. J. Pascoe (chairman), Mr. J. P. Gilliver and Mr. A. J. Nicholas (joint managing directors), and Lt.-Col. P. Dollar (director) of Aberdare Cables (Holdings), Ltd., at the works of South Wales Switchgear, Ltd.

managing directors, recently visited the Blackwood factory of South Wales Switchgear, Ltd., and in the accompanying picture they are viewing one of the new 33 kV metalclad switchgear units at the factory. Lt.-Col. P. Dollar, a director of Aberdare Cables (Holdings), is included in the party. Mr. Pascoe is also chairman and managing director of British Timken, Ltd.

The Mayor of Wembley, Councillor T. C. Wardle, attended the **B.T.H. Willesden Social and Athletic Club's** annual ball at Wembley Town Hall on 13th October. During the evening the opportunity was taken to present London Business Houses Amateur Sports Association trophies to individual and team winners, and representatives from twelve London clubs were there to receive them from Mr. E. Alexander, manager of the Willesden Works.

The Electric Construction Co., Ltd., has appointed **Mr. S. L. M. Barlow,** A.M.I.E.E., M.Amer.I.E.E., as a non-executive member of the board.

Mr. J. E. Tibbatts has been appointed works accountant of Johnson & Phillips, Ltd. He succeeds the late Mr. W. F. Smith, who died last month. Mr. Tibbatts was for many years his deputy and has served with the company on the costing and accountancy side of the business for over thirty-one years.

Mr. J. E. Tibbatts

Three performances were given last week at the Fortune Theatre by the **G.E.C. Dramatic Society** of "Johnny Belinda," by Elmer Harris. This play, which revolves round a deaf and dumb girl, is a difficult one for amateurs but a creditable standard was achieved. The part of the girl "Belinda" was played by Shirley Linge and she and her father (Frederick Coker) did very well. As a doctor (the hero of the piece) Michael Hobbins was good but perhaps a little too innocent in his acting. Other parts were well sustained by Florence Scantlebury, Colin Hannay, Brenda Bell, Barry Ramsay, Roy Appleby, Paula Kirkby and Elizabeth Stafford. The producer was Ian Stewart. The proceeds are to be given to the Electrical Trades' Commercial Travellers' Association and the Royal Association in Aid of the Deaf and Dumb.

Mr. C. Burrenstone has been appointed to the staff of Varilectric, Ltd., as sales manager. Mr. Burrenstone has represented the Dorman Smith group of companies in the southern area since 1946.

OBITUARY

Mr. A. S. Wild. — The death occurred suddenly on 13th October of Mr. Arthur Stanley Wild, LL.B., F.C.I.S., director and secretary of Gothic Electrical Supplies, Ltd., for the past twenty-one years. He was fifty.

Mr. W. F. Pearce, formerly chief engineer and general manager of the National Boiler & General Insurance Co., Ltd., died on 7th October. Mr. Pearce joined the company as an inspecting engineer in 1920 and was transferred to the head office staff in 1924. He became chief engineer in 1933 and chief engineer and general manager in 1936, retiring from active service earlier this year. The funeral, which took place at the Manchester Crematorium on 11th October, was attended by the chairman of the company and other directors, together with representatives of other insurance companies, and of the management, staff and pensioners.

Mr. Frank Walter Shilstone, of Kennedy & Donkin, consulting engineers, died on 11th October at the age of sixty-three. Mr. Shilstone had been on the firm's staff since 1919, except for a short period between 1935 and 1940.

Mr. E. Norman Beavis, sales manager of the London Fan & Motor Co., Ltd., died on 9th October.

Joint Consultation in the Supply Industry

THE progress of joint consultation in the electricity supply industry is surveyed in the annual report of the National Joint Advisory Council for 1954-55, just published.

Local Advisory Committees, in fulfilling their function of advising the management of local units, usually power stations or distribution districts, have discussed a very wide variety of subjects. Efficiency and safety were as before more often discussed than any other broad group of subjects, but more time was spent in discussing education and training than in the previous year. The general subject of welfare came fourth in the list of items to which committees gave attention. The report shows that 85 per cent of divisional L.A.C.s and 75 per cent of Area Board L.A.C.s now receive regular reports surveying technical progress, expected future developments, etc., from their chairmen, who are normally managers of the unit whose area the L.A.C. covers. The nature of the items discussed by L.A.C.s shows very clearly that the committees are well past the "canteens and wash-basins" stage through which most joint consultative committees first pass, and are now accepted as a valuable and necessary part of the industry. This is further shown by the greater frequency of L.A.C. meetings, and by the tendency for them to set up sub-committees to deal with special subjects.

Six of the District Joint Advisory Councils discussed efficiency more than any other subject, while the remaining five gave education and training first place. Safety was much discussed, but there was a fall in the amount of time given to welfare. The report draws attention to, but does not comment upon, the fact that the majority of subjects discussed by District Councils originated either in the L.A.C.s or in the National Council, and that comparatively few originated with the Boards or the trade unions.

The National Joint Advisory Council made 15 recommendations during the year on, *inter alia,* a traineeship scheme for manual workers, the principles of recruitment and selection of apprentices, the use of "Outward Bound" courses, the issue of revised safety rules for generation, transmission and distribution, methods of artificial respiration, the management of the Authority's canteens, and the dissemination of technical information. In all, the National Council has now made 124 recommendations, the great majority of which have been accepted by most Boards.

A section of the report covers a series of regional conferences for L.A.C. and D.J.A.C. members which were held throughout England and Wales and an analysis is made of the questions submitted by L.A.C.s for answer at the conferences. The questions suggested that the problem which most concerned L.A.C. members was how best to arouse interest in the advisory machinery among other employees. Other subjects on which a large number of questions were asked included the relationship between management and joint consultation; possible representation of L.A.C. elected representatives on the National and District Councils; methods of election to the L.A.C.s; operation of the Suggestion Scheme; functions of the L.A.C. chairmen; etc.

The report states that the Suggestion Scheme has continued to provide a steady flow of ideas to the industry, mostly on engineering matters. A table shows that in all 2,050 suggestions were received last year by the District Councils, the highest number coming from the Midlands Board (189), followed by the Southern Board (174) and the South Wales Board (167); no entry is included for the South Eastern Board, which operates a chairman's merit prize scheme. Awards totalled £1,482. The National Council considered 58 suggestions from the District Councils of which 39 were thought to have national application (decisions on awards for three were deferred). The value of awards made on the recommendation of the National Council was £396, individual awards varying from £5 to £50.

Formal and informal training of L.A.C. members in the practice of joint consultation has continued. Four hundred and eighty-three members attended one-week courses during the year. In addition, week-end courses were attended by 165 L.A.C. chairmen, and one-week courses by 71 L.A.C. secretaries.

Copies of the report are available to employees in the electricity supply industry from their L.A.C. secretary, and to others from Mr. R. D. V. Roberts, secretary, National Joint Advisory Council of the Electricity Supply Industry, Winsley Street, London, W.1.

Underwater Television Trials

TRIALS recently carried out by Pye, Ltd., at Lake Zurich, Switzerland, showed that when using an underwater television camera fitted with a specially designed multi-core signal cable which also acts as a lifting rope the time taken to sink and lift the camera is very much reduced. For instance, lowering a camera to the 400-500ft depth usually takes about 45 min whereas the new cable enables this to be done in two minutes. This is due to the absence of the usual wire hawser which makes a slow descent imperative because of the danger of its fouling the electric cable.

The new combined lifting rope and cable used was manufactured in one length of 1,000ft by British Insulated Callender's Cables, Ltd. It is a double plastic sheathed version of a standard polythene insulated multi-unit television camera cable with a loom woven textile finish of hemp as a final covering. This special interlocking weave provides extremely high tensile strength combined with flexibility and resistance to abrasion. It cannot fray or run loose, and owing to the individual threads being parallel with the axis of the cable there is no undue strain on the cable cores. The loom braid is clamped to the camera coupler and thus provides the necessary strength for lifting the camera.

3 CO-AXIAL UNITS OF 75 OHMS CHARACTERISTIC IMPEDANCE
3 TRIPLETS OF .022 INCH WIRES POLYTHENE INSULATED
TINNED COPPER WIRE BRAID
21 SINGLE .036 INCH WIRES POLYTHENE INSULATED
TINNED COPPER WIRE BRAID
DOUBLE PVC SHEATH
LOOM WOVEN HEMP

B.I.C.C. combined lifting rope and cable. Overall dia. of cable 1·32in

For the purposes of the trials the underwater camera was connected to the cable by means of an underwater coupler developed jointly by Pye and B.I.C.C., the cable passing over a pulley of approximately 1ft diameter and from there to a capstan of the same diameter. The cable was then flaked on to the deck of the boat in a figure "8" formation to avoid twisting, and connected to the viewing unit and ancillary equipment. The camera was lowered by allowing the cable to slip round the capstan at the rate of approximately 250ft a minute for 2 minutes and this was repeated many times. This was a severe test for the cable as the diameters of both capstan and pulleys were smaller than that normally recommended for this size of cable. The rubbing of the hemp finish on the capstan was also a severe test of the durability of the cable.

At all depths the cable resisted any twisting action and allowed the camera to remain in a fixed position indefinitely. Whilst some wear was noticeable after three days of trials this was not considered unsatisfactory as the woven hemp finish had no protective covering. No electrical failures occurred and even after winding at high speed over small diameter pulleys the circuits were all intact.

Additional tests included lifting the camera 20ft in the air and allowing it to drop near the surface of the water, the whole strain being taken by the cable. No electrical failures occurred in the cable nor did the textile finish show signs of stretching or fracture.

Nuclear Power Stations

First Two Sites Named

THE Central Electricity Authority has announced that the sites on which it proposes to build its first two nuclear power stations are at Bradwell, at the mouth of the River Blackwater in Essex, and at Berkeley, on the Severn Estuary in Gloucestershire. Subject to the approval of the sites by the Local Planning Authorities and the Minister of Fuel and Power, construction of the stations is planned to begin in 1957 and they should be contributing to public electricity supplies by 1960 or 1961. Each station will provide two to three times the amount of power to be generated at the first Calder Hall station of the United Kingdom Atomic Energy Authority where electricity is the by-product.

The Bradwell site is at the remote north-east corner of the peninsula formed by the rivers Blackwater and Crouch. The site fronts on to the broad estuary of the Blackwater where it opens out into the North Sea. The subsoil is stiff London Clay. The Berkeley site lies on the eastern bank of the Severn Estuary roughly midway between Gloucester and Bristol. The river at this point is over a mile wide and is strongly tidal. The land is flat and is underlain by Keuper Marl, providing good foundation conditions.

Geological and foundation conditions are of special importance, since the reactors and their shielding impose unusually heavy site loads. Moreover, cooling water requirements are substantially larger than for conventional stations of the same capacity. On the other hand, nuclear power stations need comparatively small quantities of fuel and the normal large-scale transport facilities are not required. In consequence it is economically advantageous to build nuclear power stations in areas where normal fuels are expensive. They should be near to centres of heavy electrical demand or to places where the grid system can readily absorb their output, the object being to run the stations continuously day and night in order to obtain the maximum production for the heavy capital investment involved.

The type of reactor to be installed in the early stations in the Authority's programme is inherently safe. The heat generated in the reactor is absorbed by coolant gas. The hot gas is piped to separate heat exchangers where steam is raised to drive turbo-generators of the conventional type. Comprehensive precautions will be taken in the design of the reactors and ancillary plant to ensure the effective containment of all radioactive materials, not only in normal operations, but in every foreseeable contingency. Irradiated fuel elements will be transported in shielded containers to the Atomic Energy Authority's processing plants. In making the announcement the C.E.A. says that the fulfilment of the "White Paper" programme, covering the commissioning of twelve nuclear power stations by 1965 and providing a generating capacity of some 1,500 to 2,000 MW, will require an immense amount of design and development work, and to maintain the time-table outlined will demand a sense of urgency on the part of all concerned. In this connection, the Authority is confident that it can count on the full co-operation of planning and other bodies whose help is essential if Britain is to remain in the forefront of nuclear development. On Monday last the Gloucestershire County Planning Committee approved in principle the C.E.A.'s proposal to erect the Berkeley station.

Automatic Control

AS the subject of his inaugural address as chairman of the Measurement and Control Section of the Institution of Electrical Engineers, Mr. W. Bamford (Everett, Edgcumbe & Co.) took the development of automatic control. This, he said, was an evolutionary extension of the industrial revolution, which was itself based upon two centuries of scientific discoveries and their application to industry, accompanied by increased demands for manufactured products.

The tendency to concentrate production in larger units would be emphasized since only these could be adapted to full automatic production. A hundred years ago in the United States, it had been stated, of the total energy used in industry 22 per cent was provided by men, 27 per cent by machines or tools and 51 per cent by animals; corresponding figures for 1950 were 2, 96 and 2, so that labour-saving was not of major importance in automatic control. It, however, enabled man to transmit instructions to a machine at the high rate at which the machine could accept them, not merely at the rate man could operate it.

The estimate by the Chancellor of the Exchequer that the standard of living in Great Britain could be doubled within 25 years implied the need either to produce more goods or the same amount in less time and that this country would maintain its share of world trade (20 per cent). To raise the standard of living by 2 per cent per annum required a steady rise of 3 to 4 per cent per annum in production and 3 per cent in exports. Average increase in production per man-hour between 1948 and 1953 had been calculated at only $1\frac{1}{2}$ per cent and a serious labour shortage seemed imminent. This forecast ignored technical developments as a means of increasing productivity. Possibly new techniques were not required so much as the application of existing techniques to hitherto untried situations, emphasizing the need for engineers rather than scientists or inventors. Machines must be made to work with the minimum of attention, as for example, in automatic factories.

Design of measurement and control equipment (e.g. as regards speed of response) must vary in accordance with individual projects. In a distillation column of an oil refinery an improvement in accuracy of control of temperature by 2 deg C would increase productivity by 0·5 per cent, representing £50,000 a year; but it was questionable whether the mechanical design of instruments equalled that of the purely electrical or electronic components.

Co-ordination of design throughout a production unit was vital. Capital expenditure on new developments might be upwards of £10,000 per worker and the use of statistical information digested by computers must be undertaken. Automatic control increased the value of technical men, but the existing ratio in numbers between them and others in a factory would certainly not be high enough in the future. The importance of disseminating new technical information in a form that would produce results was emphasized.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Japanese Competition

UP to the present we have been very successful in exporting to India and the Far East as well as other parts of the world, but just recently have encountered Japanese tenders of the kind which renders price competition impossible. Two particular instances are as follows:—

Quotation to India, for a large number of 33 kV isolating switches, £114 per switch; Japanese price, £85. In the past we have secured many valuable orders from this customer.

Formosa: Our total price on a contract including 161 kV switches, U.S.$65,635; Japanese tender, U.S.$35,112. In the past we have also secured orders for similar equipment from this customer.

We are specialist manufacturers of high-voltage outdoor equipment and we export a large proportion of our total production to some forty-six countries throughout the world. Up to now we have been successful in combating competition from all other countries where we have been able to tender on equal terms. At the present time, the loss of contracts such as those above is not serious as our order book is full, but we thought your readers might be interested in the above concrete examples of the type of competition we may have to meet in the future.

London, E.C.4. Line Equipment, Ltd.,
P. H. JACKSON,
Joint Managing Director.

Electric Cookers

I FIND "Reflector's" eternal running warfare on the gas industry a little wearing. Quite obviously there are many things that electricity can do better than gas, and as an electrical engineer myself I have no difficulty in recognizing them.

Whatever the theoretical advantages of electric cooking over gas, no amount of "electrical people should take their own medicine" and similar dogma can disguise the fact that electric cookers have serious disadvantages also.

They are not so flexible: a gas jet is infinitely variable, whereas most electric elements are controlled only by three-heat switches. No special technique has to be learned for gas—for example, it is not necessary for me to turn off the gas some minutes before I expect the milk to boil over.

Perhaps the most serious disadvantage is that price for price the finish of an electric cooker is not in the same street as that of a gas cooker. Many electric cookers for which high prices are asked have the appearance of having been blacksmithed out of bent tin.

Instead of berating "electrical people" for not buying apparatus that, as they can see for themselves, is nothing "to write home about," and the gas industry for daring to exist at all, "Reflector" would spend his time more usefully chasing electric cooker manufacturers to produce an article that will compare with its rival. Then, with the known advantages of electricity there will be no doubt about the result.

Teddington, Middlesex. F. W. JORDAN.

"Drubbing for Drones"

THANK you for your leaderette on this subject. The disease is widespread. What prevented the drones from staying on site after 5.30 p.m. to claim payment for overtime? Surely the gang is slipping!

OBSERVER.

Hire-Purchase Statistics

THE Board of Trade has asked 6,000 retailers all over the country in trades where important sales of goods on hire-purchase terms are made (for example, furniture, radio and television sets and domestic appliances) to provide monthly information on their hire-purchase business. In addition, department stores, multiple shops, retail co-operative societies and nationalized undertakings which are already sending monthly figures of their total retail trade to the Board of Trade are being invited to supplement their figures with information on their hire-purchase business, and over 450 finance houses have been asked to contribute statistics which are essential for completing the scheme.

The information collected will be used to build up representative statistics showing the monthly changes in hire-purchase sales and debts outstanding for the main types of goods sold on hire-purchase. Against these figures the trader will be able to compare the results of his own hire-purchase business and tell how he is doing in relation to the average for his trade.

A code number will be used in each return to ensure that the identity of individual firms is unknown to the staff handling the returns. Individual information will be seen only by this staff; no other officials of the Board of Trade or of any other Government Department will have access to it. The Board of Trade invites any finance house or retailer who has not received an invitation to contribute to these statistics and who is willing to do so, to send for a form from the Director of Statistics, Board of Trade, Horse Guards Avenue, London, S.W.1.

Royal Institution Lectures

Friday evening discourses at the Royal Institution up to the end of the year will include the following subjects:—"Weather Forecasting," by Sir Graham Sutton (director, Meteorological Office), 4th November; "Lightning and the Long Electric Spark," by Dr. B. F. J. Schonland (deputy director, Atomic Energy Research Establishment), 25th November; and "The Discovery of Useful Electricity," by Sir Lawrence Bragg (Fullerian Professor of Chemistry), 9th December.

There will also be four lectures on "Automatic Control and Production," by Mr. R. H. Macmillan on 25th October and 1st, 8th and 15th November. These lectures, which are to be almost entirely non-mathematical in approach and not directed at the specialist, will be extensively illustrated with models, slides and film strip. Non-members of the Institution may attend on payment of a fee of 8s for the course of four lectures or 2s 6d for a single lecture.

INDUSTRIAL NEWS

E.D.A. Public Speaking Competition

Competitors in the 1956 E.D.A. Public Speaking Competition will have a wide choice of subjects on which to speak, for, apart from the two themes selected by the organizers, they will be at liberty to speak on any matter they desire. The two set headings are "Atomic Power" and "The Influence of Television on Our Way of Life." The closing date for entries to the competition will be 1st December next.

Two booklets have just been published by E.D.A. regarding the competition. The first of these, "E.D.A. Public Speaking Competition, 1956," is intended primarily for the organizing officials of the competition. In addition to the rules, this booklet gives information on organizing the area competitions, details of the subjects and judging instructions. A new 12-page booklet has been published for this year's competition entitled "Public Speaking is Great Fun." This booklet is aimed at interesting those eligible to enter the competition. Copies of these booklets are obtainable free from the British Electrical Development Association, 2, Savoy Hill, London, W.C.2. Also obtainable, free of charge, is a booklet previously published entitled "Hints on Public Speaking."

Members of the staff of the electricity supply industry (including the generation divisions), who have not attained their 35th birthday on 31st March, 1956, are eligible to compete, excepting those who have been first place winners in previous national competitions or have competed in two previous national finals. As usual area competitions will be held, the winners going forward to the national final, held in London, where the Faraday Silver Challenge Shields are presented to the winners. In each area contest £10 is awarded to the winner and £5 to the runner-up.

Australian Import Restrictions

The *Board of Trade Journal* of 8th October gives details of the changes in import quotas put into force by the Australian Government on 1st October. It is shown that for Category A quotas are reduced by 12½ per cent from the previously current levels. Among the exceptions are electric resistance wire, tape and strip and aluminium wire (7½ per cent reduction). Quotas for Category "B" goods are reduced by 25 per cent of the existing levels. In the "Admin." category the quotas for portable electric hand tools and graphite electrodes, *inter alia*, are reduced by 7½ per cent. The classification of goods appeared in the *Board of Trade Journal* of 2nd April last. Generally speaking electrical machinery is in the "Admin." class; other electrical equipment falls into either of the other two categories.

As from 14th October the duties on a number of imports into Australia were increased as a measure of protection for home industries. Among the items principally affected are electric motors.

Cable Order from Canada

Enfield Cables, Ltd., announces that it has been awarded a contract to the value of approximately $500,000 by the Hydro-Electric Power Commission of Ontario, Canada. The cables will be laid in Ottawa, and they will cross the Rideau Canal in the capital city. Two and a half miles of 115 kV, double circuit, 80 MVA pipe-line compression cables (conductor size 300 mcm) are to be laid by Enfield Cables' Contract Department. The installation is due to be commissioned on 1st May next.

Lumenated Ceilings

Since it was formed last year, Lumenated Ceilings, Ltd., a subsidiary of Thermotank, Ltd., has had to cope with rapidly expanding business and it recently moved its London offices to larger premises at Alliance House, Caxton Street, London, S.W.1. The head office is at Helen Street, Glasgow, and the main production unit at Colneside, West Drayton, Middx. To mark the opening of the new premises in London, a reception was held last week at which Mr. R. McCullough, managing director, said that the Lumenated ceiling system of diffused lighting had been well received by architects. Already there was a good export business and during its first year these ceilings had been exported to Norway, Germany, Cyprus, South Africa, Italy, Egypt and the Lebanon. The largest installation so far covered approximately 7,400 sq ft and had been carried out at the Rochester premises of Elliott Brothers (London), Ltd.

Lumenated ceilings consist of a false ceiling of sheets of corrugated and translucent vinyl plastics. This is supported in a framework of lightweight steel and suspended below the lighting arrangements. The plastics evenly diffuse the light and the false ceiling also hides existing trunking, ducting, wires and cables.

The installation in the company's new offices, in addition to its functional use, incorporates special lamp arrangements and circuits for demonstration purposes. The main office has a Lumenated ceiling 21ft wide and 28ft long suspended 18in from the true ceiling. Illumination is provided by sixty 4ft 40 W de-luxe warm white fluorescent tubes. With the lighting full on the intensity is 35 lumens/sq ft at desk level. The manager's office has an 11ft square Lumenated ceiling, and in the plenum depth of 13in is a set of eight 12ft off-white, and a set of eight 12ft de-luxe warm white cold cathode tubes. All the lighting is fully dimming, and at desk height, with all the tubes switched on, the intensity is 90 lumens/sq ft. In the managing director's office the illumination is from fourteen 5ft de-luxe warm white fluorescent tubes in the plenum depth of 13in. At full lighting intensity a reading of 35 lumens/sq ft is obtained at desk level.

Danish Electrical Trade

Anglo-Danish trade continued at a high level throughout the period 1952-54, the United Kingdom absorbing 37 per cent of Danish exports and supplying about 27 per cent of her imports during 1954. Denmark, however, has long ceased to be a seller's market, and it is therefore important that British firms should realize the source and nature of the competition facing them if they are not only to maintain but also to improve their share of this market. While com-

The main office of the new London premises of Lumenated Ceilings, Ltd.

petition must be met from many European countries, Germany is the United Kingdom's main competitor over a wide field. These are the conclusions reached by Mr. J. Currie, Counsellor (Commercial), H.M. Embassy at Copenhagen, in his report on the economic and commercial conditions in Denmark (H.M. Stationery Office, 4s).

Imports of electrical machinery into Denmark during 1954 totalled Kr.149,620,000, of which the United Kingdom's share was Kr.27,754,000. Exports were valued at Kr.171,480,000, of which the United Kingdom took Kr.6,634,000 (Kr.19·422=£1).

Dealing with Danish engineering production, Mr. Currie says that production of cables and conductor wire is mainly in the hands of the Northern Cable & Wire Works, Ltd., and the total quantity in 1953 was 19,000 tons valued at Kr.96·3 million, against 18,800 tons valued at Kr.106·4 million in 1952. Exports of cables declined from Kr.16·7 million to Kr.12·1 million, and imports also fell from Kr.7·8 million to Kr.3·7 million in the same period.

There are twenty factories engaged in the production of electrical machinery, equipment produced including electric motors, h.v. and l.v. switchgear, elevators, cranes, deck machinery, electro-medical equipment and testing instruments of all kinds. The production of electro-mechanical and electrical equipment is growing. Production ranges from telephone and radio equipment to condensers. There are 169 factories employing 9,000 workers with a total annual value of production of about Kr.446 million.

In the instrument section, optical, mechanical and electrical instruments for laboratory and industrial uses are produced, the value of which in 1953 was Kr.20·4 million.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 15th October is deemed to be 162s 0d. The "cost of materials" figures are:—

For electrical machinery and equipment the Board of Trade index figure published on 15th October is 193·6.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 175·4; blast furnaces and iron and steel smelting and rolling (40 and 41), 156·1. The price of $\frac{3}{4}$in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 14th October) is 4s $4\frac{3}{8}$d per lb. Outstanding contracts covered by the B.O.T. intermediate products index: The index figure for intermediate products (15th October) is 380·4.

Polystyrene Development

Distrene, Ltd., is a new company jointly owned by the Distillers Co., Ltd., and the Dow Chemical Co. (U.S.A.), whose processes are being employed in the production of polystyrene and toughened polystyrene at a new factory at Barry, South Wales, on a site occupied by two other companies of the Distillers Co.—British Resin Products, Ltd., and British Geon, Ltd. At a Press reception last Monday the company exhibited many examples of mouldings in "Styrene 666" and the toughened grade "Styrene 475."

The exhibits included a number of refrigerator parts, including casings, and accumulator battery boxes, particularly for aircraft use, the material being much lighter than those formerly employed for the purpose. The producers claim "Styrene 666" to be suitable for a number of electrical uses such as motor housings, lighting fittings, condenser components and insulators. The material has an electric strength at 20 deg C of 550 V/mil. "Styrene 475" can be extruded into 48in wide sheets which can be shaped by vacuum forming technique which does away with expensive moulds.

I.E.E. Scottish Centre

The annual dinner-dance of the Scottish Centre of the Institution of Electrical Engineers will be held on 15th November (6 p.m. to midnight) at Grosvenor Restaurant, Gordon Street, Glasgow. Tickets (30s each for members and 15s each for students) can be obtained from Mr. J. H. P. de Villiers, hon. secretary, 19, Waterloo Street, Glasgow, C.2. Applications should be made not later than 7th November.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £171 0s 0d
COPPER, H.C. Electro	ton £347 10s 0d
Fire Refined 99·70%	ton £346 0s 0d
Fire Refined 99·50%	ton £345 0s 0d
COPPER Tubes ..	lb 3s 4d
Sheet	ton £413 10s 0d
H.C. wire and strip ..	ton £387 10s 0d
LEAD, English ..	ton £107 5s 0d
Foreign	ton £106 0s 0d
MERCURY	flask £91 10s 0d
TIN, block (English) ..	ton £757 15s 0d
ZINC, G.O.B. Foreign	ton £90 15s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 7$\frac{1}{2}$d
Sheet	ton £326 5s 0d
Wire	lb 3s 3$\frac{1}{2}$d
PHOSPHOR BRONZE Wire	lb 4s 10$\frac{1}{2}$d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 35$\frac{7}{8}$d—36d

Electrical Machinery Trades Convention

The Council of the Association of Electrical Machinery Trades, at a recent meeting held at the Mount Hotel, near Wolverhampton, decided that the Association's Convention for 1956 should be held at the Palace Hotel, Southport, from Saturday, 14th April, to Tuesday, 17th April. As already announced, the Association is holding its annual ball at the Savoy Hotel, London, W.C.2, on 4th November and members of the Association requiring tickets should apply to the secretary, 100, Park Street, W.1.

E.C.A. Year Book

The 1955-56 edition of this substantial volume (763 pp.) is now available. It is generally of the same nature as its predecessors, brought up to date. There are the usual features of value to electrical contractors and others, including the Electrical Fair Trading Policy which appears in its new (sixth) edition. Copies can be obtained from the Electrical Contractors' Association, 14, Bedford Row, London, W.C.1, at 20s, plus 1s postage.

Stud Welding Conference

At the invitation of the stud welding organization of Crompton Parkinson, Ltd., the leading stud welding interests of fifteen overseas countries sent representatives to London recently to review development and research experience gained since the previous meeting in Paris in September, 1953. The meetings in London were followed by a visit to the Crompton Parkinson stud welding factory in South Wales.

Domestic Electricity

In last week's issue of the *Electrical Review*, in the section dealing with space heating (page 736), it was stated that all Berry's Electric "Raydair" background heaters are equipped with a variable thermostat. In actual fact only the 890/1, 890/1$\frac{1}{2}$ and 890/2 models are so equipped; the 880/1, 880/1$\frac{1}{4}$ and 880/1$\frac{1}{2}$ heaters have pre-set thermostatic cut-outs. The "Raydair" heater illustrated on the same page is the 890/2 model and not 880/2 as indicated in the caption.

E.A.W. Annual Conference

The 31st annual conference of the Electrical Association for Women will be held at Llandudno from 30th April to 3rd May. The detailed programme of speakers and events will be issued later, but the Association's current campaign entitled "Planning for Light" will form a prominent part of the conference.

Electricity in Housing

"Electricity a Power of Good for Improvements and Conversions" will be the theme of the Electrical Development Association's stands (5D/8D) at the National Housing and Town Planning Exhibition to be held at the Corn Exchange, Brighton, from 26th to 28th October.

A showcard will point out that there are several million houses in this country built from 50 to 80 years ago, structurally sound but without amenities now recognized as standard, and that the provision in these houses of electric lighting, with electric

cooker, electric water heater and socket outlets, new sinks, bathroom and improved water supply, amounts to only a fraction of the cost of a new house. The part played by electricity in typical improvement schemes will be outlined by display matter.

A section of the stand will be devoted to showing how the electric immersion heater can be combined with a back boiler or independent solid fuel appliance. The importance of the efficient lagging of the hot water storage tank will be stressed.

There will be on display examples of electric cookers, washing machines, etc. Details will also be displayed of the ring circuit method of wiring houses.

Institute of Welding

The autumn meeting of the Institute of Welding will be held in London from 2nd to 4th November. The technical sessions, including the presidential address, will be at the Institution of Civil Engineers, Great George Street, London, S.W.1, and they will be devoted to the various aspects of inert-gas arc welding processes. The annual dinner of the Institute will be held at the Park Lane Hotel on 2nd November, when the principal guest will be Mr. F. J. Erroll, M.P., Parliamentary Secretary to the Ministry of Supply.

Electric Traction Courses

Staff members of several public road passenger transport undertakings last week took part in a tour of electrical manufacturers' works in the Midlands. The tour, the first of a series, was arranged by B.E.A.M.A. electric traction equipment manufacturers as part of an educational course. Members attending the course visited works of electric traction equipment manufacturers at Rugby, Birmingham and Sheffield. Lectures by experts in electric traction were given, with daily discussions and demonstrations. Considerable interest has been shown in this experiment, both by public transport operators and by the employees themselves. The courses are intended for operators' trainees of graduate or higher national certificate standard or other specially selected candidates who, in the opinion of the operating managers, are worthy of encouragement. Further similar courses will be arranged, and inquiries for full particulars should be addressed to the secretary, Electric Traction Section, the British Electrical and Allied Manufacturers' Association (Inc.), 36, Kingsway, London, W.C.2.

Members attending the experimental course arranged by B.E.A.M.A. electric traction equipment manufacturers, with the organizers at one of the Midlands works

New Display Stands

The Hotpoint Electric Appliance Co., Ltd., has issued new display stands to be used with three of its products. They are for the "Torribar" safety electric kettle and the "Plus 5" and lightweight electric irons. The displays will be distributed to the trade by the local branch offices.

Three new display stands issued by the Hotpoint Electric Appliance Co., Ltd.

Refresher Course for Plant Engineers

A comprehensive refresher course for senior works and plant engineers in London and the Home Counties, sponsored by the Earl of Halsbury (managing director, National Research Development Corporation), is to be held in London this winter at the Royal Empire Society, Northumberland Avenue, W.C.2. It comprises nineteen lectures on Wednesday evenings commencing 2nd November, and is organized by the Education Committee of Incorporated Plant Engineers in conjunction with leading industrialists and technical authorities. The fee for the course is four guineas and copies of the syllabus and full particulars may be obtained from the secretary to the refresher course, at the Royal Empire Society.

Caravan Site Wiring

A caravan site in an attractive rural setting at Red Lion Bridge, Scarisbrick, Lancashire, has been improved by the addition of an electricity supply to each caravan. The system adopted consists of a 300 yd length of l.v. paper-insulated, lead-sheathed, single-wire armoured and served cable supplying sixteen underground cast-iron compound-sealed boxes from each of which a length of v.r.i. 250 V lead-covered, steel-wire armoured and served cable supplies in turn the switch and fuses of a cubicle above ground.

From each of the sixteen cubicles a three-core p.v.c. flexible (in some cases buried direct in the earth, protected against mechanical damage, and in others in ducts on the surface of the grass verge) leads to a small connection box under the floor of the caravan and from that point the supply is taken into the caravan by a twin polythene-insulated and p.v.c.-sheathed cable. The cables were manufactured by British Insulated Callender's Cables, Ltd., and installed by J. H. Butterworth, electrical contractor, of Ormskirk.

Education of the Young Worker

Organized by the Department of Education, University of Oxford, a conference on the education of young workers is to be held at Oriel College, Oxford, from 7th to 13th April, 1956. It will consider the needs of those preparing for relatively unskilled occupations and who leave school at the age of 15 to work in mines and factories, on the land and in offices, etc., whose brief training offers few opportunities of intellectual and personal development. Commissions will be formed for the study of these questions and lectures will be given on selected aspects of the broader subject. The inclusive fee is £12 and full particulars and membership forms can be obtained from the secretary, "Young Worker," 15, Norham Gardens, Oxford.

B.C.E. Exhibition

The annual exhibition and cocktail party of the British Central Electrical Co., Ltd., was held on 30th September at Grosvenor House, Park Lane, London, W., nearly 600 visitors from all parts of the country being received by the managing director, Mr. G. Conradi, and Mrs. Conradi. A wide range of electrical products was exhibited, a number of the exhibits being shown for the first time. In addition to the British Central Electrical Co.'s stand, there were displays

by the Automatic Coil Winder & Electrical Equipment Co., Ltd., Brentford Electric, Ltd., British Thomson-Houston Co., Ltd., Cantie Switches, Ltd., Cayson Electrics, Ltd., General Electric Co., Ltd., Lancashire Dynamo & Crypto, Ltd., Truvox, Ltd., and Uni-Tubes, Ltd. During the evening there was an excellent floor show by Eric Ross and his Dazzle Cabaret. New products shown on the stand of the British Central Electrical Co., included the "Infini-Angle" lamp which can be assembled with one, two, three or four arms, a full load earth continuity tester, the "Briticent" neutral loop impedance tester, a portable fluorescent hand lamp, "Fonocord" telephone cords, and a new "Briticent" industrial switch plug, made in five sizes ranging from 8 to 125 A.

AC-Delco Expansion

Last week Mr. C. N. Faulconbridge, general manager of AC-Delco (Division of General Motors, Ltd.), officiated in cutting the first turf on a 42-acre site at the Liverpool Kirkby Industrial Estate. This ceremony started ground levelling operations by John McGeogh & Sons, Ltd., for the new expansion scheme and third plant of the AC-Delco Division. The Kirkby plant will be constructed in stages, the first of which, amounting to 250,000 sq ft, will cost over £2,000,000. This third plant will supplement the output of the two existing factories of the company at Dunstable and Southampton.

Radio-controlled Tractor

At its Mechanized Farming Centre at Boreham, Essex, the Ford Motor Co., Ltd., recently demonstrated a radio-controlled Fordson Major diesel tractor. It is believed to be the first radio-controlled tractor to be shown in this country. The small control box transmits six different commands to the tractor, governing its turning left and right, clutch operation, the raising and lowering of the implement, and the fuel cut-off mechanism.

The tractor is controlled by a simple battery-operated transmitter working at a frequency of 27·12 Mc/s and provides for six separate but not simultaneous channels by means of audio-frequency modulation of the carrier, the receiver having tuned reed output relays for reception of the individual signals which in turn operate secondary relays to provide excitation from the 12 V tractor battery for the solenoids connected to the tractor controls. A bank of coloured lights on the tractor indicate the electrical functions and provide a continuous check on the operation of the radio transmitter and receiving gear. The hydraulic system consists of a Plessey "Series 3" pump installation with the associated drive from the front end of the motor, a header tank of 5 gal capacity fitted underneath the radiator, a Keelavite control valve and a solenoid operated by-pass valve, together with control valves and hydraulic cylinders.

The design and installation of the equipment was carried out by Fenlow Products, Ltd., Weybridge, Surrey, and includes radio equipment supplied by Radio & Electronic Products, the hydraulic pump by Plessey and control valves by Keelavite.

The stand of Johnson & Phillips, Ltd., which was awarded second prize at the recent P.O.A. Minibition

Television in Egypt

The Egyptian Government has issued a call for tenders for the supply and erection of the first part of the "general project for television." Specifications and general conditions of tender may be obtained from the General Stores Department of the Egyptian Broadcasting Service, 4, Sharia Sherifein, Cairo, at a cost of £E.5. The latest date for the receipt of tenders is 21st November.

Pakistan Protective Duties

The *Board of Trade Journal* reports that the Government of Pakistan has decided to continue until 31st December the protection to the home industrial type power switchboard industry.

A seasonable window display by the G E C. at Magnet House, Kingsway. Depth has been given to the window by the use of model figures

Works Visit

A party of Shropshire electrical contractors, headed by Mr. Tom Berrow of Shrewsbury, recently visited the works at Kitts Green, Birmingham, of James Beresford & Son, Ltd., to see pumping plant in course of manufacture. The party toured the works and saw some of the large submersible electric pumps being built for coal mine de-watering. They were entertained to lunch at the works and were welcome by the general manager, Mr. G. Pope.

Educational

An advance course on "Power System Planning and Economics" will be held at the Heriot-Watt College, Edinburgh, on six successive Saturday mornings, commencing on 22nd October. The fee is £2 2s and particulars can be obtained from the secretary of the College, Chambers Street, Edinburgh.

The 1955-56 Calendar of the University of London is now available. As in previous years it contains much useful information on the organization of the University in addition to the various prospectuses.

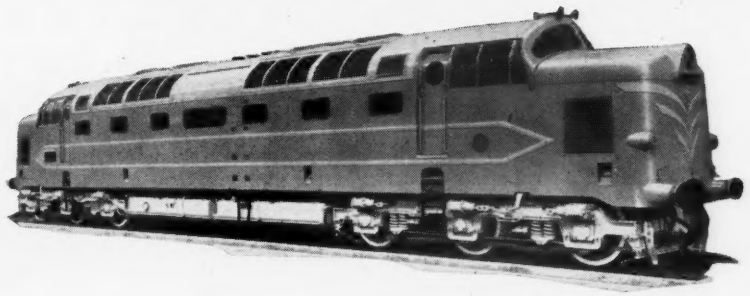
Trade Announcements

Teddington Aircraft Controls, Ltd., has an agreement with Giannini, Ltd., the British affiliate of G. M. Giannini & Co., Inc., of New York and Pasadena, for the manufacture and marketing of Giannini pressure transducers, accelerometers and potentiometers, and their development to meet the specific requirements of British industry. A team of technicians is visiting the United States to become conversant with the design and manufacturing techniques.

The address of **Refractory Mouldings & Castings, Ltd.,** is now Pleasant Place, Kegworth, Leics.

W. T. Glover & Co., Ltd., are opening new offices and stores on 31st October at 41, Bridge Street, Aberdeen (telephone: Aberdeen 28060), and at 7, Dock Street, Dundee (telephone: Dundee 3824). The branch manager is Mr. W. Geekie.

Mr. Tom Murphy now represents the **Stanton Ironworks Co., Ltd.,** in North Eastern England. His address is 22, Queensway, Brunton Park, Gosforth, Newcastle-on-Tyne (telephone: Wideopen 511).



English Electric 3,300 h.p. " Deltic " diesel-electric locomotive for main line passenger and express freight duties

TRIALS OF NEW ENGLISH ELECTRIC UNIT

Powerful Diesel-Electric Locomotive

WHAT is claimed to be the most powerful single unit diesel-electric locomotive in the world, the " Deltic " locomotive, made at the English Electric Company's Preston works, is now undergoing trials in North-West England. This 3,300 h.p. Co-Co locomotive weighs 106 tons and is intended for main-line passenger and freight duty. It has been designed for a maximum speed of 90 m.p.h. in service, but it can be geared for higher speeds. It has a long central compartment with a driving cab at each end, and is of striking appearance.

The most significant feature of this new locomotive is the horsepower to weight ratio (72 lb/h.p.). The two 18-cylinder " Deltic " engines were designed and manufactured by D. Napier & Son, Ltd.

For normal working in railway service, both power units will run together. The engines are simultaneously controlled by means of air-pressure actuators operating the engine governor mechanism. The engine torque is automatically adjusted to the load and speed setting. Change-over switches are provided so that either power unit can drive all six traction motors, and therefore with only one power unit in operation the tractive effort of the locomotive is not affected, though the locomotive will operate at about half maximum speed.

Electrical contacts actuated by the servo-mechanism of the engine governor cause the field strength of the main generator to be adjusted so that at all times the output of the generator matches the available h.p. of the corresponding engine. Automatic continuous power control, throughout all engine and locomotive speeds, is thus provided.

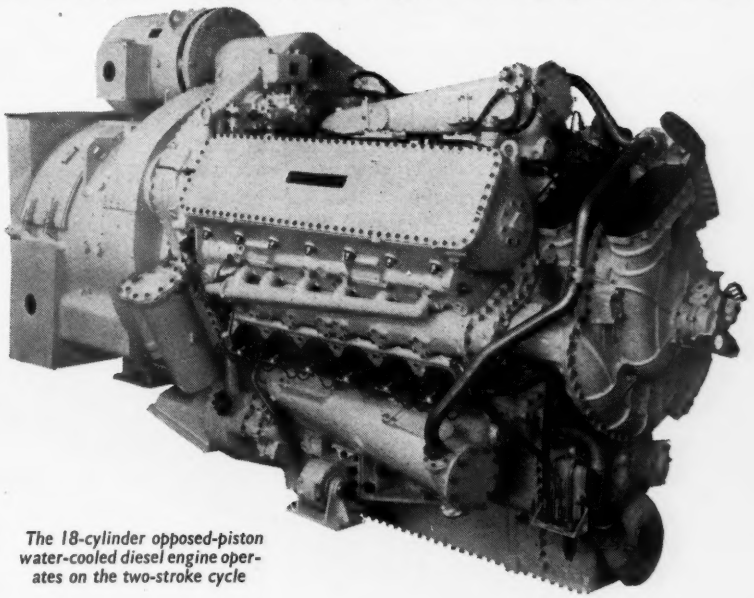
The locomotive superstructure is arranged with a long central compartment, a driving cab at each end of this compartment and a nose-end in front of each driving cab. The central compartment contains the two power units with the automatic oil-fired train-heating boiler.

The boiler is capable of evaporating 2,000 lb of water per hour at 80 lb/sq in. Sufficient water for four hours' operation of the boiler is carried and a bi-directional water pick-up device is fitted to enable the water tanks to be replenished from water troughs while the train is in motion. A storage battery, principally used for engine starting, is also accommodated between the power units. Control cubicles at each end of the engine compartment form the rear bulkheads for the drivers' cabs. The nose compartments contain the air compressor and vacuum exhauster together with traction motor blowers, resistances, brake equipment, reservoirs and additional control equipment.

Removable roof sections are provided above each nose compartment and over the engine generator compartments and boiler. The generator roofs accommodate the main air intakes for cooling the generators and the roofs over the engine the radiators and fans for the engine coolant and lubricating oil. The radiator fans (two for each engine) are mechanically driven from their respective engines. The roof over the boiler, which also covers the silencers, accommodates the air intakes for the engines and boiler fire. Fuel tanks and boiler feed water tanks are carried below on the underframe between the bogies.

The engine embodies a triangular form of cylinder disposition. It is an 18-cylinder, opposed piston, water-cooled diesel engine, operating on the two-stroke cycle. The cylinders are arranged in three banks of six, each bank containing a crankshaft, the cylinders forming, in end view, an inverted equilateral triangle, hence the name " Deltic."

At the driving end of the engine a train of gears connects the three crankshafts to the main output shaft at the centre of the triangle, the overall ratio being 1/1 and the maximum speed 1,500 r.p.m. The main output shaft of the engine is solidly coupled to the main generator armature



The 18-cylinder opposed-piston water-cooled diesel engine operates on the two-stroke cycle

shaft. An auxiliary output shaft is driven from a tributary gear train and runs at 1·679 times the engine speed. This drives the auxiliary generator armature and the cooling fans for the radiators. Engine starting is obtained by motoring the main generator from the storage battery.

The locomotive has six traction motors, connected in three parallel pairs across the two outer feeders of the two main generators connected in series. The motors are arranged to have two stages of field weakening which obtains as an automatic feature. This feature, however, can be cut out as under certain traffic conditions, such as hauling heavy loads at slow speed, it is necessary to operate the traction motors in full field only.

Principal Data

Diesel engines	Two 18-cylinder "Napier Deltic" 2-stroke.
Rating	3,300 h.p.
Tractive effort—maximum	60,000 lb
Tractive effort—continuous	31,000 lb at 33 m.p.h.
Maximum service speed	90 m.p.h.
Number of traction motors	6
Weight in running order	106 tons
Overall height from rail level ...	12ft 10½in
Overall width	8ft 9½in
Length over buffer beams	64ft
Bogie wheel base	14ft 4in
Distance between pivot centres ...	44ft
Maximum axle load	18 tons
Minimum curve negotiable	6 chains
Fuel capacity	800 gal
Heating boiler evaporation capacity ...	2,000 lb/hr at 80 lb/sq in
Water capacity for train heating fitted with water pick-up apparatus ...	600 gal
Brakes	Air on locomotive vacuum for train

Mining Electrical Engineers

TOO few of the many electrical engineers employed in the mining industry have the requisite qualifications for membership of the Institution of Electrical Engineers, Mr. T. G. Dash stated in his chairman's address to the Western Centre. He attributed this to former unattractive conditions, but since nationalization in 1947 these had gradually improved and salaries were now comparable with those in other industries. Appreciation of the importance of electric power in mining and the introduction of the Coal Mines (Mechanics and Electricians) General Regulations, 1954, had recently improved their status.

In pre-war years electrical progress underground had been slower than in general industry, largely because of the risk of electrical ignition of gas near the coal face. Better ventilation was now preventing harmful accumulations of gas, and the tendency was towards making the mines safe electrically instead of depending wholly on safe constructions of apparatus. On the surface, however, the mining industry compared well with other industries. In South Wales a mining company was the first in Britain to have a 33 kV transmission system and generating plant with steam conditions of 350 lb/sq in at 750 deg F, and was among the first to adopt 1,500 lb/sq in. In the past few years there had been a remarkable advance in the use of electricity, particularly for coal mining and conveying underground, although the basic method of mining at a number of pits had been fundamentally changed and a large amount of equipment, much of it flameproof, had been introduced for the first time.

The statutory responsibilities imposed by the new Regulations required a colliery unit engineer to hold at least a Higher National Certificate and a craftsman to hold at least an Ordinary National Certificate. The "ladder plan" of the National Coal Board together with the national apprenticeship scheme covered five years in different workshops with one day a week for technical education. Satisfactory progress in practical and theoretical work during this period would result in certification as "electricians for the mine." The most successful trainees were given opportunities to qualify as "electrical engineers in charge of the mine," which could lead to corporate membership.

Under the N.C.B. scheme of "directed practical training" persons having the qualities required for administrative or technical responsibility and possessing degrees and diplomas or comparable qualifications in electrical engineering were given three years special training for taking up positions of executive responsibility.

Engineering Industries Association

THE London Regional organization of the Engineering Industries Association held its eighth annual exhibition last week at the New Hall of the Royal Horticultural Society, London. The Association now has some 3,600 members. A principal aim is the encouragement of member firms to become familiar with the products and services of fellow members and the exhibitions held in London have proved valuable to this end as well as in promoting considerable trade, principally internal to this country.

The possibilities of printed circuitry were demonstrated by Printed Circuits, Ltd., who produce "Plasmet" continuous copper etched wiring circuits, valuable in saving space and production time, etc. Another interesting show was that of Lion Electronic Developments, Ltd., of Feltham, Middlesex, who displayed their "Leocast" process for the "encapsulating" of electronic circuits and components in resins.

Winston Electronics had a recently developed "loud-to-loud" telephone system which is claimed to be a major advance on any similar units available. Satisfactory operation can be achieved at speaking distances up to 20ft from the instrument.

Nalder Bros. & Thompson, Ltd., have produced an automatic earth proving supply point which secures the immediate isolation of any suitably wired portable electric tool fed from it, should the earth leads to the tool casing become defective. Testing of the earth connections commences before the portable tool is energized and continues as long as it is in use. The apparatus, available for single- or three-phase tools, is contained in a metal case either wall mounting or portable. It comprises a hand operated double- or triple-pole circuit-breaker, a relay, l.v. transformer and a non-linear resistor. On the side of the case is a four- or five-pole output socket. In the case of a single-phase machine the cores are connected to line and neutral and to two separate earthing points on the tool casing. Basically a current from the l.v. transformer is circulated through the two earth leads and the metal casing of the tool and should this fall below a certain value, the supply is tripped out.

The Engineering Industries Association has started a scheme of apprentice training under which a number of smaller firms co-operate to ensure a more complete range of training than any one of them could provide alone. The first training group has been formed from twelve member firms ranging in size from 30 to 500 employees.

Eighth Power Convention

As already announced, the eighth British Electrical Power Convention is to be held at Torquay from Wednesday, 23rd, to Tuesday, 29th May, 1956, under the presidency of Sir John Dalton, A.M.I.E.E., F.C.I.S., chairman, W. T. Henley's Telegraph Works Co., Ltd. About 2,000 delegates are expected to attend.

The theme of the Convention will be "Electricity and Transport," and papers by eminent persons in the electricity, transport and manufacturing industries will deal with the many aspects of the use of electricity in the transport world. The subjects discussed will probably refer to the modernization of the British railways, battery-electric vehicles, trolley-buses, signalling, electricity in shipping and aircraft, etc.

There will also be a lecture and demonstration which will appeal to the housewife and the public in general, on "The All-Electric House," showing new developments.

Scottish Hydro-Electric Development

A.S.E.E. Presidential Address

MR. BRYAN DONKIN gave his presidential address to the Association of Supervising Electrical Engineers yesterday (Thursday) in the lecture theatre of the Institution of Electrical Engineers. He took as his subject "Hydro-Electric Development in North Scotland." Practically all the constructional work in this development has been carried out under the ægis of various firms of consulting engineers, including Mr. Donkin's own firm, and he was therefore well qualified to describe it.

As a beginning, he dealt with the constitution of the North of Scotland Hydro-Electric Board and the clauses incorporated in its constitution for safeguarding the interests and amenities of the area, and went on to consider some of the schemes so far completed or under construction. Over ninety miles of rock tunnel had been drilled in connection with the various schemes, these being, with few exceptions, of horse-shoe section, concrete lined. Heads used varied widely from that of Morar (16ft) to that of Finlarig (1,362ft) resulting in the selection of a wide range of type of turbo-alternator. The Sloy, Glen Affric, Conon Valley, Shin, Tummel-Garry, Shira, Skye and Lochalsh, Garry and Moriston schemes were all described in some detail. The last scheme has underground power stations, the first of this type to be constructed in Scotland.

Other forms of power generation used by the Board included a number of diesel stations, of a temporary or a permanent nature, the latter in remote communities where water power resources did not exist and transmission was uneconomic. Most of these were in the Orkney, Shetland and Hebridean islands. At present nine modern diesel stations with an installed capacity of 28·6 MW were in use.

A 12 MW gas turbine of the closed cycle type was being installed at Dundee to run on oil but experiments were in hand to run a similar type of turbine on pulverized peat. Surveys had shown that there were 170,000 acres of peat bog in the Highlands. An experimental peat-burning power station was under construction in the bog district of Caithness.

A wind-driven generator of 100 kW had been built in the Orkneys and recent reports indicated that it was now supplying power fairly constantly to the local 11 kV network.

The Board had taken over 207 circuit miles of 132 kV lines at vesting day and since then approximately 953 circuit miles had been added, with a further 200 at present under construction. Two principal collecting centres were in use, in the north at Beauly and in the south at Errochty. A route was being selected from Beauly for a possible 275 kV line to supply the increasing demand in Aberdeen and the north east. To assist with the winter maintenance of remote transmission lines, refuge huts had been built in which linesmen could shelter overnight if necessary and where a certain amount of repair material could be kept. Short-wave radio was used to communicate with these huts.

Local control centres had been established to deal with those stations which could naturally be grouped together for operational purposes; and a central control room in Pitlochry arranged the general programme of output and co-ordinated the export of power to the South of Scotland Electricity Board.

Particular attention had been given by the Board to the increased use of electricity on the farm. There were 19,300 farms in their area and of these 41·2 per cent had been connected by the end of 1954. Electrically-operated grass dryers had been installed in some places, used on a community principle by a number of crofters.

Among the incidental activities promoted during their hydro-electric developments the Board had encouraged the quarrying and stone building industries and a number of power stations were built in attractive stones. It was interesting to note that in some cases stone-built stations were costing less than those of brick and reinforced concrete. Roads and fisheries were among the other community helping activities.

At the end of 1954 the installed plant capacity of the Board was 594 MW including 431 MW of hydro sets. A further 398 MW of hydro plant was under construction. The use of the plant had saved the country some 700,000 tons of coal in a year of high rainfall and this annual saving should be doubled within the next five years.

Mr. Donkin's address was copiously illustrated with coloured slides. During the evening he also presented the various Association awards, among them the Branch Merit Cup, the W. E. Highfield Shield, the Alfred Brammer Trophy and the Individual Merit Cup.

British Industries Fair

First List of Exhibitors

We are informed by Mr. Kenneth Horne, the managing director of British Industries Fair, Ltd. (Ingersoll House, 9, Kingsway, London, W.C.2), that over half the space allocated to the Electrical Section of next year's British Industries Fair at Olympia, London (23rd April to 4th May), has been booked. About fifty concerns are to arrange displays and there are several other tentative bookings. We give below a list of those definitely taking part in the London Section of the Fair:—

EXHIBITORS IN THE ELECTRICAL SECTION, B.I.F., OLYMPIA

Aidas Electric, Ltd.
Anglo-Netherland Technical Exchange, Ltd.
B.K.B. Electric Motors, Ltd.
Bastian & Allen, Ltd.
Belmos Co., Ltd.
Benn Bros., Ltd.
Berry's Electric, Ltd.
British Electrical Development Association
Best Products, Ltd.
British Thomson-Houston Co., Ltd.
British Vacuum Cleaner & Engineering Co., Ltd.
Brook Motors, Ltd.
Bruce Peebles & Co., Ltd.
Bulpitt & Sons, Ltd.
Campbell Engineering Co., Ltd.
Chilton Electric Products, Ltd.
Clang, Ltd.
Corfield-Sigg, Ltd.
Crompton Parkinson, Ltd.
Dimplex, Ltd.
E.M.I. Electronics, Ltd.
Edison Swan Electric Co., Ltd.
Electric Construction Co., Ltd.
Electrical Industries Export
Electrical Review
Enfield Cables, Ltd.
Evershed & Vignoles, Ltd.
Ferranti, Ltd.
Fitzgibbon & Murray, Ltd.
General Electric Co., Ltd.
Hawkins, L. G., & Co., Ltd.
Hoover, Ltd.
Hotpoint Electric Appliance Co., Ltd.
Houchin, Ltd.
Jenson & Nicholson, Ltd.
Langley London, Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
McGeoch, Wm., & Co., Ltd.
New Welbeck, Ltd.
Newman Industries, Ltd.
Osborn Manufacturing Co., Ltd.
Parsons, C. A., & Co., Ltd.
Reyrolle, A., & Co., Ltd.
Siemens Bros. & Co., Ltd.
South Wales Switchgear, Ltd.
Stewarts & Lloyds, Ltd.
Temperature, Ltd.
West, Allen, & Co. Ltd.
Yorkshire Copper Works, Ltd.

Domestic Electrical Equipment

Low Temperature Heaters

FROM the safety aspect, particularly where young children are concerned, the use of low-temperature heaters is eminently suitable as at all times the elements are completely enclosed and the low surface temperature of the outer casing reduces the possibility of burns.

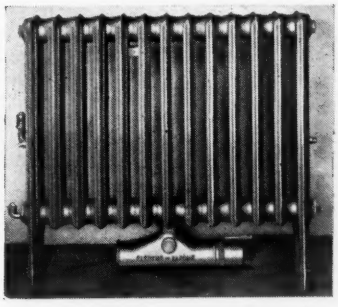
Altogether there are well over thirty manufacturers of this type of heater in one form or another including water- and oil-filled radiators, convectors, fan heaters, panel heaters, etc.

British National Electrics, Ltd., announce new and improved models in their 1955-56 range, including the P.20 2 kW convector and the lower priced P.15 1½ kW model, and H. Frost & Co., Ltd., now produce a 2 kW version of their popular "Sunhouse" convector. Contemporary styling is a feature of the Falk, Stadelmann "Caprice" 2 kW panel convector and its easily gripped handles and concealed rubber wheels allow for complete freedom of movement.

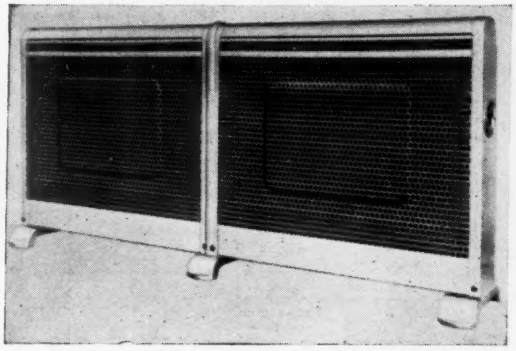
With few exceptions there has been an increase in prices since our survey at this time last year.

Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
BELLING & CO., LTD., Bridge Works, Enfield, Middx.	"Champion" 91A	Portable	22¾ × 9¾ dia.	750 W	2-heat	Steel	Silver bronze	£3 12 6	£1 6 7
	"Champion" 92A	Portable	23¾ × 10¼ dia.	1·5 kW	2-heat	Steel	Silver bronze	£4 5 0	£1 11 2
	"Champion" 83A	Portable	24½ × 13 dia.	2½ kW	3-heat	Steel and cast iron	Silver bronze	£5 12 6	£2 1 3
	"Radiant-Convector" 750	Portable	26 × 20¾ × 9¾	1 kW radiant and 1·5 kW convection	3-heat	Steel	Silver bronze	£15 0 0	£5 10 0
	"Convector" 751B	Portable	24 × 20½ × 8	1 kW	2-heat	Steel	Silver bronze	£7 6 0	£2 13 7
	"Convector" 752B and 752AB	Portable	24 × 36 × 8	2 kW (752B) 3 kW (752AB)	3-heat	Steel	Silver bronze	£11 17 6 (752B) £12 12 6 (752AB)	£4 7 1 (752B) £4 12 7 (752AB)
	"Zephyr" 851	Portable	21 × 18 × 5⅛	1 kW	2-heat (thermostat extra)	Steel	Two-tone bronze	£7 6 0	£2 13 7
	"Zephyr" 852	Portable	21 × 32 × 5⅛	2 kW	3-heat (thermostat extra)	Steel	Two-tone bronze	£11 10 0	£4 4 4
	"Zephyr" 853	Portable	21 × 45 × 5⅛	3 kW	3-heat (thermostat extra)	Steel	Two-tone bronze	£15 0 0	£5 10 0
	"Warm Air Circulator" 85	Wall fixing	23⅛ × 6 × 5	750 W	2-heat	Steel	Silver bronze	£4 15 0	£1 14 10
	"Warm Air Circulator" 86	Wall fixing	23⅛ × 12 × 5	1·5 kW	2-heat	Steel	Silver bronze	£7 10 0	£2 15 0
	"Warm Air Circulator" 87	Corner fixing	23⅛ × 9 × 6½	750 W	2-heat	Steel	Silver bronze	£5 0 0	£1 16 8
	"Handy Heater" 952	Floor mounting	13 × 4½ dia.	250 W	—	Steel and cast iron	Bronze	£1 15 0	£0 12 10
	"Zephyr" 851F	Wall fixing	22¼ × 18 × 6¼	1 kW	2-heat (thermostat extra)	Steel	Two-tone bronze	£7 6 0	£2 13 7
	"Zephyr" 852F	Wall fixing	22¼ × 32 × 6¼	2 kW	3-heat (thermostat extra)	Steel	Two-tone bronze	£11 10 0	£4 4 4
	"Zephyr" 853F	Wall fixing	22¼ × 45 × 6¼	3 kW	3-heat (thermostat extra)	Steel	Two-tone bronze	£15 0 0	£5 10 10
	"Air Warmer" 961A	Wall or floor mounting	3¾ × 8 × 13¾	500 W	—	Cast iron	Vitreous enamel	£2 0 0	£0 14 8
	"Air Warmer" 962A	Wall or floor mounting	3¾ × 8 × 18	1 kW	—	Cast iron	Vitreous enamel	£2 10 0	£0 18 4
BENHAM & SONS, LTD., 66, Wigmore Street, London, W.1.	"Electro-Vapour" 4 PR	Semi-portable	22 × 21 × 5⅛	1 kW	Single or 3-heat switch	Cast iron	Sprayed aluminium or bronze paint	£18 5 0	£6 13 3
	"Electro-Vapour" 6 PR	Semi-portable	28 × 27 × 5⅛	1½ kW	Single or 3-heat switch	Cast iron	Sprayed aluminium or bronze paint	£21 17 0	£7 19 6

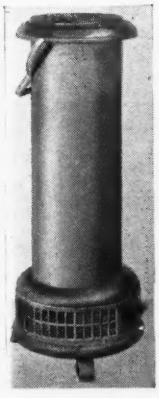
Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
BENHAM & SONS, LTD., 66, Wigmore Street, London, W.1. (continued)	" Electro-Vapour " 7 PR and 7 PS	Semi-portable	28×31×5½ (7 PR) and 28×21×8½ (7 PS)	2 kW	Single or 3-heat switch	Cast iron	Sprayed aluminium or bronze paint	£24 0 0	£8 15 3
	" Electro-Vapour " 8 PS	Semi-portable	28×27×8½	2½ kW	Single or 3-heat switch	Cast iron	Sprayed aluminium or bronze paint	£26 17 6	£9 16 2
	" Electro-Vapour " 9 PS	Semi-portable	28×33×8½	3 kW	Single or 3-heat switch	Cast iron	Sprayed aluminium or bronze paint	£29 5 0	£10 13 7
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1.	" Raydair " 880/1	Portable or wall mounting	20×26×7⅜	1 kW	Pre-set thermostatic, safety cut-out	Steel	Peach bronze or penny bronze	£9 15 0	£3 11 4
	" Raydair " 880/1¼	Portable or wall mounting	20×26×7⅜	1¼ kW	Pre-set thermostatic, safety cut-out	Steel	Peach bronze or penny bronze	£9 15 0	£3 11 4
	" Raydair " 880/1½	Portable or wall mounting	20×34×7⅜	1½ kW	Pre-set thermostatic, cut-out	Steel	Peach bronze or penny bronze	£12 12 0	£4 12 1
	" Raydair " 890/1	Portable or wall mounting	20×22½×7¼	1 kW	Variable thermostatic	Steel	Peach bronze or penny bronze	£10 12 6	£3 17 8
	" Raydair " 890/1½	Portable or wall mounting	20×30½×7¼	1½ kW	Variable thermostatic	Steel	Peach bronze or penny bronze	£13 15 6	£5 0 9
	" Raydair " 890/2	Portable or wall mounting	20×45×7¼	2 kW	Variable thermostatic	Steel	Peach bronze or penny bronze	£21 5 0	£7 15 5
BESCOL (ELECTRIC), LTD., 118, Parkfield Road, Saltley, Birmingham, 8.	242	Portable	15¾×11½×4¾	1 kW	—	Steel	Various colours	£3 19 6	£1 9 2
	244 and 245	Portable	28×18¾×6½	2 kW	Switch (244) or thermostat (245)	Steel	Various colours	£6 17 0 (244) £8 14 0 (245)	£2 10 3 (244) £3 3 10 (245)
	" De-Luxe " 260 and 262	Portable	25×20×7	2 kW	Switch (260) or thermostat (262)	Steel	Various colours	£8 18 6 (260) £10 13 6 (262)	£3 5 6 (260) £3 18 4 (262)
	" Hot-Tot "	Portable	17×11½ dia.	1 kW	—	Steel	Various colours	£2 5 0	£0 16 6

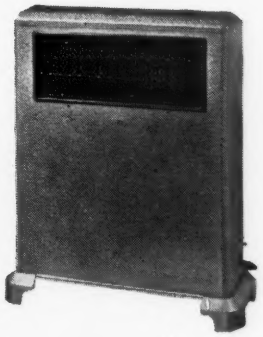


Benham " Electro-Vapour " radiator

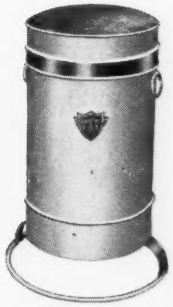


Berry's 890/2 " Raydair " heater





Belling 751 convector and (left) Belling 92A " Champion " heater



Bescol " Hot-tot " heater and (right) Bescol " De-Luxe " portable convector

LOW TEMPERATURE HEATERS . . . . . *continued*

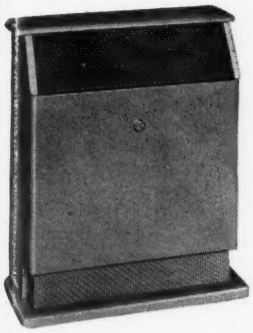
Manufacturer	Name or Model	Type	Size (H.W. & D) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
BRITISH NATIONAL ELECTRICS, LTD., Newarthill, Motherwell, Lanarkshire.	P.20	Portable	24½ × 19¾ × 8½	2 kW	Thermostatic	Steel	Black crackle or hammered grey, flame gold louvres	£11 0 0	£4 0 6
	P.15	Portable	22½ × 19¾ × 8½	1½ kW	Thermostatic	Steel	Black crackle or hammered grey, flame gold louvres	£7 15 0	£2 16 10
E. K. COLE, LTD., Thermovent Heating, 5, Vigo Street, London, W.1.	FR1 and FRC1	Portable	23 × 16⅛ × 9½	1 kW	None (FR1) Thermostatic (FRC1)	Plastic	Polished walnut	£8 10 0 (FR1) £10 10 0 (FRC1)	£3 2 2 (FR1) £3 13 2 (FRC1)
	FR2 and FRC2	Portable	23 × 25⅛ × 9½	2 kW	Half-heat (FR2) Thermostatic (FRC2)	Plastic	Polished walnut	£11 10 0 (FR2) £12 10 0 (FRC2)	£4 4 2 (FR2) £4 11 5 (FRC2)
	SR1 and SRC1	Portable or wall fixing	23 × 15⅛ × 8⅞	1 kW	None (SR1) Thermostatic (SRC1)	Steel	Light bronze stoved enamel	£7 15 0 (SR1) £9 5 0 (SRC1)	£2 16 9 (SR1) £3 7 8 (SRC1)
	SR2 and SRC2	Portable or wall fixing	23 × 24⅛ × 8⅞	2 kW	Half-heat (SR2) Thermostatic (SRC2)	Steel	Light bronze stoved enamel	£10 0 0 (SR2) £11 0 0 (SRC2)	£3 13 2 (SR2) £4 0 6 (SRC2)
	SR3 and SRC3	Portable or wall fixing	23 × 24⅛ × 8⅞	3 kW	Half-heat (SR3) Thermostatic (SRC3)	Steel	Light bronze stoved enamel	£11 0 0 (SR3) £12 0 0 (SRC3)	£4 0 6 (SR3) £4 7 9 (SRC3)
	B1 and BC1	Inset	22½ × 14½ × 1⅜ (panel) 18½ × 12⅜ × 5½ (recess)	1 kW	External switch (B1) Thermostatic (BC1)	Plastic panels, steel grilles	Walnut or black panels, gold enamelled grilles	£10 0 0 (B1) £11 10 0 (BC1)	£3 13 2 (B1) £4 4 2 (BC1)
	B2 and BC2	Inset	22½ × 23⅛ × 1⅜ (panel) 18½ × 21 × 5½ (recess)	2 kW	External switch (B2) Thermostatic (BC2)	Plastic panels, steel grilles	Walnut or black panels, gold enamelled grilles	£12 7 6 (B2) £13 15 0 (BC2)	£4 10 6 (B2) £5 0 7 (BC2)
	MRL 75, 75/S and 75/TC	Wall mounting	20 × 13⅜ × 6	750 W	None (75), on/off switch (75/S), thermostatic (75/TC)	Steel	Cream enamel	£7 10 0 (75) £7 18 3 (75/S) £8 15 0 (75/TC)	£2 14 11 (75) £2 18 0 (75/S) £3 4 1 (75/TC)
	MRL 1, 1/S and 1/TC	Wall mounting	20 × 13⅜ × 6	1 kW	None (1), on/off switch (1/S), thermostatic (1/TC)	Steel	Cream enamel	£7 10 0 (1) £7 18 3 (1/S) £8 15 0 (1/TC)	£2 14 11 (1) £2 18 0 (1/S) £3 4 1 (1/TC)
	MRL 15, 15/S, 15/C and 15/TC	Wall mounting	20 × 22½ × 6	1½ kW	None (15), on/off switch (15/S), 3-heat and off switch (15/C), thermostatic (15/TC)	Steel	Cream enamel	£10 10 0 (15) £10 18 3 (15/S) £11 8 0 (15/C) £11 15 0 (15/TC)	£3 16 10 (15) £3 19 11 (15/S) £4 3 5 (15/C) £4 6 0 (15/TC)
	MRL 2, 2/S, 2C and 2/TC	Wall mounting	20 × 22¼ × 6	2 kW	None (2), on/off switch (2/S), 3-heat and off switch (2/C), thermostatic (2/TC)	Steel	Cream enamel	£10 10 0 (2) £10 18 3 (2/S) £11 8 0 (2/C) £11 15 0 (2/TC)	£3 16 10 (2) £3 19 11 (2/S) £4 3 5 (2/C) £4 6 0 (2/TC)
	RG75	Radiant glass wall panel	16¾ × 24⅝ × 1¼	750 W	External switch required	Armour plate glass	Light bronze reflector edges	£6 10 0	£2 7 7
	RG1	Radiant glass wall panel	16¾ × 32⅝ × 1¼	1 kW	External switch required	Armour plate glass	Light bronze reflector edges	£7 15 0	£2 16 8
	RGF75	Radiant glass wall panel with frame	19¾ × 27¾ × 2	750 W	External switch required	Armour plate glass	Light bronze frame	£8 10 0	£3 2 2
	RGF1	Radiant glass wall panel with frame	19¾ × 35¾ × 2	1 kW	External switch required	Armour plate glass	Light bronze frame	£10 0 0	£3 13 2
CROSSLANDS (RUGELEY), LTD., 55, Ebury Street, London, S.W.1.	900/1	Portable	22½ × 23½ × 3¼–5	1 kW	—	Steel	Old gold or antique bronze	£6 5 0	£2 5 2
	900/2	Portable	22½ × 23½ × 3¼–5	2 kW	Half-heat switch	Steel	Old gold or antique bronze	£7 12 6	£2 15 0
	900/3	Portable	22½ × 23½ × 3¼–5	3 kW	Three-heat switch	Steel	Old gold or antique bronze	£8 10 0	£3 1 5
DIMPLEX, LTD., Totton, Southampton.	A.38	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	20½ (+2 with feet) × 26 × 7½ (feet), 3½ (brackets) or 12 (castors)	500 W	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£9 10 0	£3 9 6

British Nation
P.15

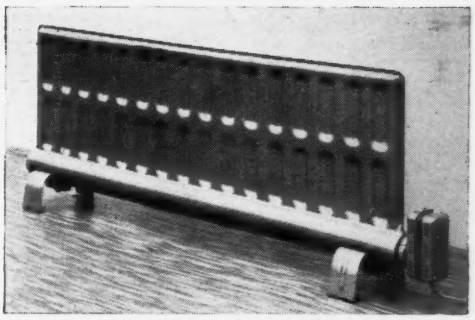
Cros

Manufacture

DIMPLEX, LTD
Totton,
Southampton.
(continued)

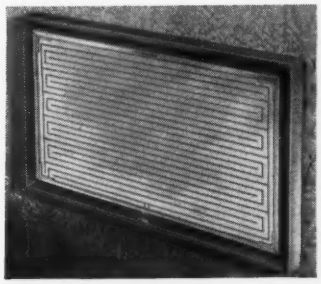


British National Electrics model P.15 convector



Dimplex B.310 ¾ kW model, fitted with towel rail and (right) Dimplex B.216 ¾ kW oil-filled radiator

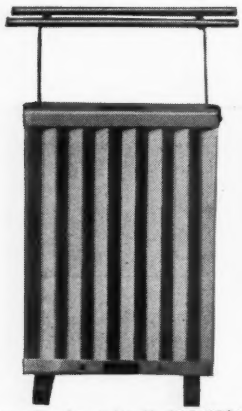
Crossland 2 kW convector



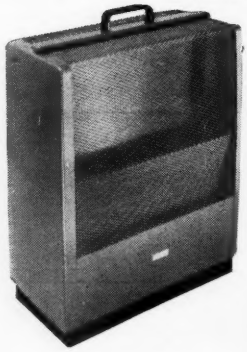
E. K. Cole radiant glass "Thermopanel" and (right) E. K. Cole "Thermovent" FRC1 model

Manufacturer	Name or Model	Type	Size (H. W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
DIMPLEX, LTD., Totton, Southampton. *(continued)*	B.48	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	26½ (+2 with feet) ×26×7½ (feet), 3½ (brackets) or 12 (castors)	750 W	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£11 10 0	£4 4 0
	B.310	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	20½ (+2 with feet) ×31½×7½ (feet), 3½ (brackets) or 12 (castors)	750 W	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£11 10 0	£4 4 0
	B.216	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	14½ (+2 with feet) ×47½×7½ (feet), 3½ (brackets) or 12 (castors)	750 W	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£12 0 0	£4 7 9
	C.412	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	26½ (+2 with feet) ×36⅞×7½ (feet), 3½ (brackets) or 12 (castors)	1 kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£13 10 0	£4 18 9
	C.220	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	14½ (+2 with feet) ×57⅞×7½ (feet), 3½ (brackets) or 12 (castors)	1 kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£14 10 0	£5 6 0
	ER.316	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	20½ (+2 with feet) ×47½×7½ (feet), 3½ (brackets) or 12 (castors)	1¼ kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£15 10 0	£5 13 3
	D.416	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	26½ (+2 with feet) ×47½×7½ (feet), 3½ (brackets) or 12 (castors)	1⅝ kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£17 10 0	£6 8 0
	D.320	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	20½ (+2 with feet) ×57⅞×7½ (feet), 3½ (brackets) or 12 (castors)	1⅝ kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£17 10 0	£6 8 0

LOW TEMPERATURE HEATERS . . . . . *continued*

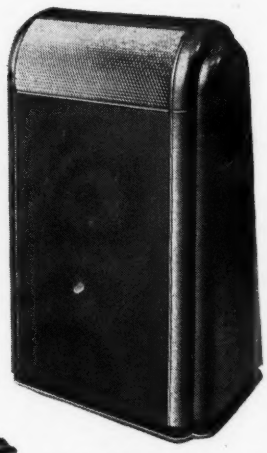


Thos. Dryden "Airo" ARO/500/S model fitted with double towel rail

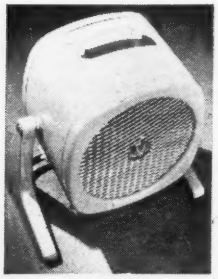


Frost "Sunhouse" 2 kW convector

Falk Stadelmann "Caprice" U.95715 panel convector



Falk Stadelmann "Peerless" U.95699 convector

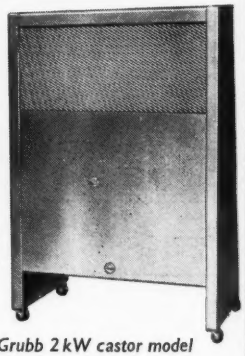


Gillott de luxe "Cotswold" fan heater

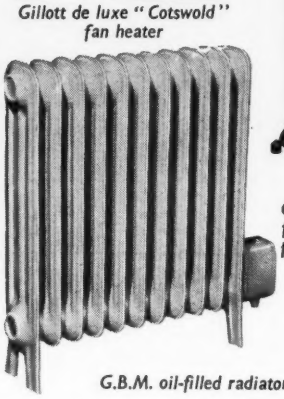
Below : G.E.C. D2800A convector heater

Ferranti C.F. 5168 1 kW background heater

Gillott "Chalford" portable 1 kW heater



Grubb 2 kW castor model



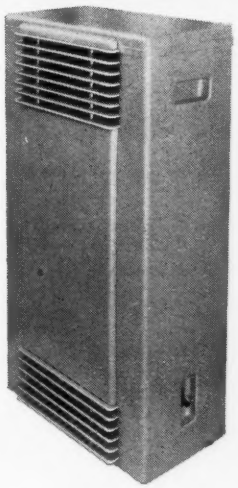
G.B.M. oil-filled radiator

Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
DIMPLEX, LTD., Totton, Southampton *(continued)*	E.420	Panel, oil-filled: supplied with feet or wall brackets. Castor wheels extra	26½ (+2 with feet) ×57⅜×7½ (feet), 3½ (brackets) or 12 (castors)	2 kW	Thermostatic, pilot light	Sheet steel	Stoved enamel, eight colours	£21 10 0	£7 17 3
	100	Column, oil-filled: supplied with feet. Castor wheels extra	21 (+3 with feet) ×21¼×6 (feet) or 12 (castors)	1 kW	Thermostatic, pilot light	Steel	Stoved enamel, eight colours	£15 10 0	£5 13 3
	150	Column, oil-filled: supplied with feet. Castor wheels extra	21 (+3 with feet) ×30×6 (feet) or 12 (castors)	1½ kW	Thermostatic, pilot light	Steel	Stoved enamel, eight colours	£19 10 0	£7 2 6
	200	Column, oil-filled: supplied with feet. Castor wheels extra	21 (+3 with feet) ×39½×6 (feet) or 12 (castors)	2 kW	Thermostatic, pilot light	Steel	Stoved enamel, eight colours	£24 10 0	£8 19 3
THOS. DRYDEN & SON, LTD., Grimshaw Street, Preston.	"AIRO-S" ARO/500/S and ARO/750/S	Portable	18¼×13¾×2	500 W and 750 W	—	Steel	Cream, silver, green, brown, grey and white	£3 12 6 (500 W) £3 17 6 (750 W)	£1 6 6 (500 W) £1 8 4 (750 W)
	"AIRO-S" ARO/1000/S and ARO/1500/S	Portable	18¼×27×2	1 & 1½ kW	—	Steel	Cream, silver, green, brown, grey and white	£5 19 0 (1 kW) £6 5 0 (1½ kW)	£2 3 6 (1 kW) £2 5 9 (1½ kW)
	"AIRO-LS" ARO/250/LS, ARO/500/LS and ARO/750/LS	Portable	18¼×13¾×2	250 W 500 W and 750 W	—	Steel	Cream, silver, green. brown, grey and white	£3 12 6 (250 W) £5 15 0 (500 W) £5 19 0 (750 W)	£1 6 6 (250 W) £2 2 0 (500 W) £2 3 6 (750 W)

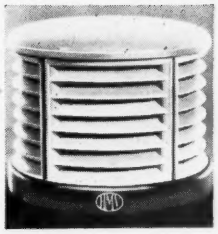
Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
ELECTROWAY HEATERS, LTD., Rosebery Street, Loughborough.	C.2 and C.21 (illuminated)	Portable	30×21×6	2 kW	Single switch	Steel	Bronze, chromium grille	£9 0 6 (C.2) £9 13 6 (C.21)	£3 6 2 (C.2) £3 10 11 (C.21)
	C.3 and C.31 (illuminated)	Portable	30×21×6	3 kW	Two switches	Steel	Bronze, chromium grille	£10 3 3 (C.3) £10 13 0 (C.31)	£3 14 6 (C.3) £3 18 1 (C.31)
	C.W.2 and C.W.21 (illuminated)	Wall mounting	24×26½×6	2 kW	Single switch	Steel	Bronze, chromium grille	£9 0 6 (C.W.2) £9 13 6 (C.W.21)	£3 6 2 (C.W.2) £3 10 11 (C.W.21)
	C.W.3 and C.W.31 (illuminated)	Wall mounting	24×26½×6	3 kW	Two switches	Steel	Bronze, chromium grille	£10 3 3 (C.W.3) £10 13 0 (C.W.31)	£3 14 6 (C.W.3) £3 18 1 (C.W.31)
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	" Peerless " U.95699	Portable	25½×16×10½	2 kW	Step	Steel	Stoved enamel, hammered pewter	£10 10 0	£3 17 0
	" Caprice " U.95715	Portable panel	20¾×22⅜×3⅜	2 kW	Step	Steel	Stoved enamel and chromium, hammered gold or pewter, contemporary colours	£9 10 0	£3 9 8
FERRANTI, LTD., Domestic Appliance Sales, Moston, Manchester, 10.	C.F.5168	Portable	17⅜×19×6¼	1 kW	Safety device prevents over-heating	Sheet steel	Hammered bronze	£7 6 3	£2 13 5
H. FROST & CO., LTD., Fieldgate, Walsall.	" Sunhouse " 5075	Portable	22½×8×8	¾ kW	No switch. Suitable for a.c./d.c. supply	Pressed steel	Stoved enamel, hammered brown, black plinth	£4 4 6	£1 11 1
	" Sunhouse " 5100	Portable	22½×8×8	1 kW	Half or full-heat a.c. switch	Pressed steel	Stoved enamel, hammered brown, black plinth	£4 7 6	£1 12 2
	" Sunhouse " 5200 and 5201	Portable	22½×16×8	2 kW	Half or full-heat a.c. switch (5200) Thermostatic (5201)	Pressed steel	Stoved enamel, hammered brown, black plinth	£6 18 6 (5200) £7 18 6 (5201)	£2 10 11 (5200) £2 18 3 (5201)
G.B.M. (ELECTRICAL) BIRMINGHAM, LTD., 439, Moseley Road, Birmingham, 12.	P.1	Panel oil-filled	27½×21½×2	500 W	Thermostatic	Pressed steel	Hammered gold	£9 5 0	£3 7 8
	P.2	Panel oil-filled	27½×28⅝×2	750 W	Thermostatic	Pressed steel	Hammered gold	£11 10 0	£4 4 0
	P.3	Panel oil-filled	27½×35⅝×2	1 kW	Thermostatic	Pressed steel	Hammered gold	£13 10 0	£4 18 9
	P.4	Panel oil-filled	27½×49⅝×2	1½ kW	Thermostatic	Pressed steel	Hammered gold	£16 17 6	£6 3 4
	P.5	Panel oil-filled	33½×61¾×2	2 kW	Thermostatic	Pressed steel	Hammered gold	£21 10 0	£7 17 2
	C.1	Column oil-filled	18 (+2 for castors) ×21×5	500 W	Thermostatic	Steel	Hammered gold	£9 17 6	£3 12 2
	C.2	Column oil-filled	24 (+2 for castors) ×24¼×5	1 kW	Thermostatic	Steel	Hammered gold	£13 13 0	£4 19 9
	C.3	Column oil-filled	24 (+2 for castors) ×35½×5	1½ kW	Thermostatic	Steel	Hammered gold	£18 17 6	£6 18 0
	C.4	Column oil-filled	24 (+2 for castors) ×44×5	2 kW	Thermostatic	Steel	Hammered gold	£23 10 0	£8 11 10
GENERAL ELECTRIC CO., LTD. Magnet House, Kingsway, W.C.2.	D.2800A	Portable	27×16½×7½	1½ kW	Half or full-heat switch	Steel	Bronze	£8 12 0	£3 2 11
GILLOTT ELECTRO APPLIANCES, LTD., Chalford, Nr. Stroud, Gloucester.	" Chalford "	Portable	24×7 dia	1 kW	Single heat	Steel	Hammered bronze	£3 4 6	£1 3 7
	" Gloucester "	Portable	25×8¼×8½	1¾ kW	Half-heat switch	Steel	Hammered bronze	£4 0 8	£1 9 6
	" Cotswold " Standard	Portable wall mounting fan heater	13½×11×7	1½ kW	Fan or element switch	Steel	Hammered bronze, ivory handle	£6 3 8	£2 5 3
	" Cotswold " De-Luxe	Portable wall mounting fan heater	13½×11×7	1½ kW	Fan or element switch (motor 2-speed controlled)	Steel	Hammered bronze, ivory handle	£7 19 6	£2 18 4
GRUBB ENGINEERING CO., LTD., 100, Mary Street, Birmingham, 12.	" Grubb " Convector	Portable (castors extra)	25×18×3	2 kW	Half-heat switch	Steel	Hammered gold lustre	£6 5 0 £6 10 0 (castors)	£2 5 8 £2 7 6 (castors)
	" Grubb " Radiators	Oil-filled " Dome "	23×32 to 28½×75½	500 W to 2 kW	Thermostatic	Steel	Hammered gilt or cream	£10 10 0 to £22 7 0	£3 13 1 to £8 3 5
	" Grubb " Radiators	Oil-filled castor	23×32 to 28½×75½	500 W to 2 kW	Thermostatic	Steel	Hammered gilt or cream	£10 12 6 to £22 16 0	£3 17 8 to £8 6 9

LOW TEMPERATURE HEATERS . . . . . *continued*

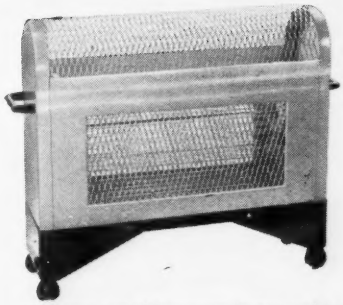
Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
HEATOVENT ELECTRIC, LTD., Lomond Street, Glasgow, N.2.	Metal	Portable	16×15½×5½ to 23×24×6	1 to 3 kW	Full or half-heat switches or thermostatic	Steel	Brown, gold or bronze	£7 0 0 to £14 0 0	£2 15 2 to £5 2 4
	Console	Portable	23×21¾×6½	2 kW	Thermostatic	Wood veneer	Mahogany, walnut or oak or bird's eye maple	£13 0 0 (m.w. or o.) £15 0 0 (maple)	£4 15 0 (m.w. or o.) £5 9 8 (maple)
HEATRAE, LTD., Heatrae Works, Norwich.	321	Portable	34½×18½×6½	1 kW	By arrangement	Steel	Brown enamel	£8 18 6	£3 5 4
	322	Portable	34½×29×6½	2 kW	By arrangement	Steel	Brown enamel	£14 7 6	£5 5 2
	323	Portable	34½×41×6½	3 kW	By arrangement	Steel	Brown enamel	£17 13 6	£6 9 3
H.M.V. HOUSEHOLD APPLIANCES, LTD., Hayes, Middlesex.	"Cavendish"	Portable fan heater	13½×11¼×11	2 kW	Fusible link	Plastic, metal base	Cream, purple-brown base	£8 8 0	£3 1 5
HOBOURN DOMESTIC APPLIANCES, LTD., Strood, Rochester, Kent.	W.H.1	Wall mounting	18×19⅜×4⅝	1½ kW	On/off, half-heat or thermostatic	Steel	Stoved enamel colours	£5 16 0	£2 2 8
	P.W.H.1	Portable	22½×19¼×5	2 kW	Half-heat or thermostatic	Steel	Ivory or hammered gold	£6 18 0	£2 10 9
	P.N.H.3	Portable nursery heater	17×19×5¼	1,200 W	Safety cut-out	Steel	Pink or blue	£6 10 0	£2 7 9
	"Ocean" 1	Oil-filled radiator	24¾×19¾×8	720 W	3-heat switch	Steel	Cream stoved enamel	£15 17 0	£5 16 6
	"Ocean" 2	Oil-filled radiator	26×26×8	1,200 W	3-heat switch	Steel	Cream stoved enamel	£17 5 10	£6 7 1
	"Ocean" 3	Oil-filled radiator	28×31¾×8	1½ kW	3-heat switch	Steel	Cream stoved enamel	£20 12 1	£7 11 5
C. HOUNSLOW & CO., LTD., Chalex Works, Southwick, Sussex.	"Standard" 1 and 1.T.	Portable	27×14×9½	1 kW	Unswitched (1) Thermostat (1.T.)	Steel	Hammered beige	£6 16 6 (1) £9 7 5 (1.T.)	£2 10 2 (1) £3 8 11 (1.T.)
	"Standard" 2, 2.T. and 2.T.S.	Portable	27×16×9½	2 kW	Half-heat switch (2) Thermostat (2.T.) Thermostat and switch (2.T.S.)	Steel	Hammered beige	£8 10 8 (2) £10 5 10 (2.T.) £11 3 2 (2.T.S.)	£3 2 9 (2) £3 15 8 (2.T.) £4 2 0 (2.T.S.)
	"Standard" 9, 9.T. and 9.T.S.	Portable	27×16×9½	3 kW	Half-heat switch (9) Thermostat (9.T.) Thermostat and switch (9.T.S.)	Steel	Hammered beige	£10 2 2 (9) £11 17 4 (9.T.) £12 14 8 (9.T.S.)	£3 14 4 (9) £4 7 3 (9.T.) £4 13 7 (9.T.S.)
	"Superb" 21, 21.T. and 21.T.S.	Portable	30×16×9½	2 kW	Half-heat switch (21) Thermostat (21.T.) Thermostat and switch (21.T.S.)	Steel	Hammered antique gold, gilt louvres	£9 18 6 (21) £11 13 8 (21.T.) £12 11 0 (21.T.S.)	£3 12 11 (21) £4 5 11 (21.T.) £4 12 3 (21.T.S.)
	"Superb" 22, 22.T. and 22.T.S.	Portable	30×16×9½	3 kW	Half-heat switch (22) Thermostat (22.T.) Thermostat and switch (22.T.S.)	Steel	Hammered antique gold, gilt louvres	£11 10 0 (22) £13 5 2 (22.T.) £14 2 6 (22.T.S.)	£4 4 6 (22) £4 17 5 (22.T.) £5 3 10 (22.T.S.)
	"De Luxe" 3, 3.T. and 3.T.S.	Portable	27½×16¼×9	2 kW	Half-heat switch (3) Thermostat (3.T.) Thermostat and switch (3.T.S.)	Steel	Hammered beige and black	£11 0 0 (3) £12 15 2 (3.T.) £13 12 6 (3.T.S.)	£4 0 10 (3) £4 13 9 (3.T.) £5 0 2 (3.T.S.)
	"Dual Purpose" 24	Portable radiant/convector	27×16×9⅛	1 kW convection and 1 kW radiant	Separate switches	Steel	Hammered beige	£10 10 0	£3 17 2
	"Dual Purpose" 25	Portable radiant/convector	27×16×9⅛	2 kW convection and 1 kW radiant	Separate switches	Steel	Hammered beige	£11 3 2	£4 2 0
	"Triangle" 4	Portable (corner fitting)	32×21×10¾	2 kW	Half-heat switch	Steel	Bronze and black	£9 6 5	£3 8 6
	"Wall Type" 5 and 6	Wall fixing	23½×17×5¾	1 kW (5) 2 kW (6)	Switch	Steel	Bronze	£5 10 3 (5) £6 18 1 (6)	£2 0 6 (5) £2 10 9 (6)
	"Dual Purpose Wall Type" 12	Wall fixing radiant/convector	23½×17×5¾	1 kW convection and 1 kW radiant	Separate switches	Steel	Bronze	£8 5 5	£3 0 10

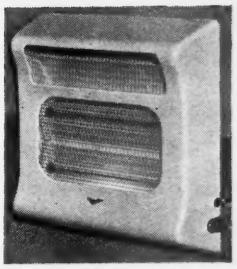


Hounslow "Chalex" convector heater



H.M.V. "Cavendish" room heater

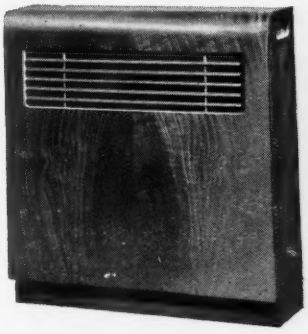


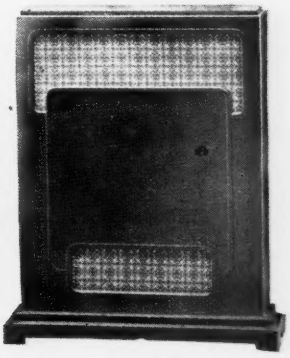


Hobourn portable nursery heater and (right) Hobourn wall mounting model

Right: Hounslow "Albany" convector

Below: Heatovent "Console" convector



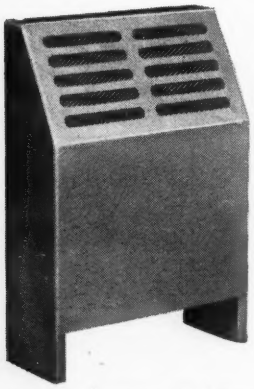


Heatrae 323 portable convector

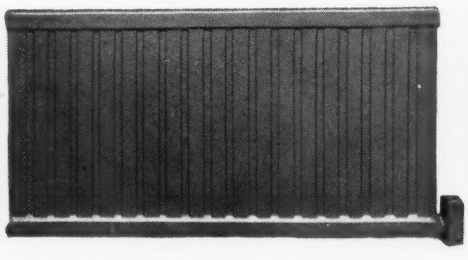
Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
C. HOUNSLOW & CO., LTD., Chalex Works, Southwick, Sussex. (continued)	"Dual Purpose Wall Type" 15	Wall fixing radiant/convector	23⅛ × 17 × 5¾	2 kW convection and 1 kW radiant	Separate switches	Steel	Bronze	£9 16 11	£3 12 4
	"Panel Inset" 7, 8 and 16	Flush wall fitting	19⅛ × 21⅛ × 1⅛	2 kW	Unswitched (8) Thermostat (7) Thermostat and switch (16)	Steel	Figured walnut or hammered beige	£9 8 3 (8) £11 7 7 (7) £14 0 1 (16)	£3 9 2 (8) £4 3 8 (7) £5 2 11 (16)
	"Panel Inset" 26, 27 and 29	Flush wall fitting	19⅛ × 21⅛ × 1⅛	3 kW	Unswitched (29) Thermostat (26) Thermostat and switch (27)	Steel	Figured walnut or hammered beige	£10 19 9 (29) £12 19 1 (26) £15 11 7 (27)	£4 0 9 (29) £4 15 3 (26) £5 14 6 (27)
	"Pixie" 18 and 19	Wall fixing	14⅛ × 12 × 4⅛	750 W (18) or 1 kW (19)	Switch	Steel	Hammered beige	£5 10 3 (18) £5 10 3 (19)	£2 0 6 (18) £2 0 6 (19)
	"Standard Offset" 13, 14 and 17	Wall fixing	19⅛ × 21⅛ × 5⅛	2 kW	Unswitched (14) Thermostat (13) Thermostat and switch (17)	Steel	Figured walnut or hammered beige	£9 8 3 (14) £11 7 7 (13) £14 0 1 (17)	£3 9 2 (14) £4 3 8 (13) £5 2 11 (17)
	"Standard Offset" 32, 33 and 34	Wall fixing	19⅛ × 21⅛ × 5⅛	3 kW	Unswitched (34) Thermostat (32) Thermostat and switch (33)	Steel	Figured walnut or hammered beige	£10 19 9 (34) £12 19 1 (32) £15 11 7 (33)	£4 0 9 (34) £4 15 3 (32) £5 14 6 (33)
	"Albany" 35 and 35.T.	Portable	21 × 16 × 5¼	1 kW	Unswitched (35) Thermostat (35.T.)	Steel	Hammered beige	£5 5 0 (35) £7 15 11 (35.T.)	£1 18 7 (35) £2 17 4 (35.T.)
	"Albany" 36, 36.T. and 36.T.S.	Portable	21 × 16 × 5¼	2 kW	Half-heat switch (36) Thermostat (36.T.) Thermostat and switch (36.T.S.)	Steel	Hammered beige	£6 17 7 (36) £8 12 9 (36.T.) £9 10 1 (36.T.S.)	£2 10 7 (36) £3 3 6 (36.T.) £3 9 10 (36.T.S.)
	"Albany" Dual Purpose 37	Portable radiant/convector	21 × 16 × 5¼	1 kW convection and 1 kW radiant	Separate switches	Steel	Hammered beige	£7 17 6	£2 17 11

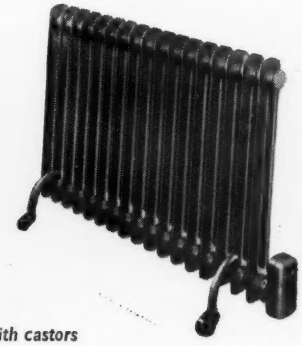
LOW TEMPERATURE HEATERS . . . . . *continued*

Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
HURSEAL, LTD., 229, Regent Street, London, W.1.	" Popular "	Oil-filled portable column	24×22×5½	1 kW	Thermal cut-out	Steel	Bronze	£13 17 6	£5 1 6
	T.V.½–1	Oil-filled portable panel	27×29×⅜ to 27×48×⅜	½ to 1 kW	Thermostatic	Steel	Bronze and cream	£7 10 0 to £13 17 6	£3 9 6 to £5 1 6
	P.1–9	Oil-filled panel or wall fixing	18×31×⅜ to 30×79×¾	½ to 2 kW	Thermostatic	Steel	Bronze and cream	£8 19 6 to £21 19 6	£3 10 0 to £8 11 5
M. & J. LOSSOS & CO., LTD., 29-31, Beethoven Street, London, W.10.	" Kaloric "	Cabinet	19⅞×12½×6¼	750 W	Switch, thermostat extra	Steel	Bronze or cream	£6 15 0 (bronze) £7 10 0 (cream)	£2 9 5 (bronze) £2 14 10 (cream)
	" Kaloric "	Cabinet	19⅞×12½×6¼	1 kW	Switch, thermostat extra	Steel	Bronze or cream	£6 15 0 (bronze) £7 10 0 (cream)	£2 9 5 (bronze) £2 14 10 (cream)
	" Kaloric "	Cabinet	25⅜×22×7	2 kW	Switch, thermostat extra	Steel	Bronze or cream	£10 10 0 (bronze) £11 10 0 (cream)	£3 16 10 (bronze) £4 4 1 (cream)
	" Kaloric "	Cabinet	25⅜×22×7	3 kW	Switches. thermostat extra	Steel	Bronze or cream	£12 0 0 (bronze) £13 0 0 (cream)	£4 7 9 (bronze) £4 15 0 (cream)
MIDLAND ELECTRIC MFG. CO., LTD., Tyseley, Birmingham, 11.	" Memvair "	Portable	24×22×6½	1 kW	Thermostat if required	Steel	Bronze	£7 15 0 £9 10 0 (with thermostat)	£2 16 8 £3 9 6 (with thermostat)
	" Memvair "	Portable	24×22×6½	1½ kW	Switch or thermostat	Steel	Bronze	£8 18 0 £10 4 0 (with thermostat)	£3 5 1 £3 14 7 (with thermostat)
	" Memvair "	Portable	24×32×6½	2 kW	Switch or thermostat	Steel	Bronze	£11 15 0 £13 2 0 (with thermostat)	£4 5 11 £4 15 10 (with thermostat)
	" Circulair "	Portable	22¼×7½×7½	1 kW	—	Steel	Bronze	£3 8 0	£1 4 10
MORPHY-RICHARDS, LTD., 6, Conduit Street, London, W.1.	RP/75	Portable	17½×14×6	750 W	—	Steel	Warm bronze	£3 7 6	£1 4 9
	RP/10	Portable	17½×18×6	1 kW	—	Steel	Warm bronze	£3 15 0	£1 7 5
	QU/10	Portable	27×17×9	1 kW	—	Steel	Warm bronze	£5 5 0	£1 18 5
	QS/20 and QT/20	Portable	27×21×9	2 kW	Half-heat switch (QS/20) Thermostat (QT/20)	Steel	Warm bronze	£6 10 0 (QS/20) £7 5 0 (QT/20)	£2 7 6 (QS/20) £2 13 0 (QT/20)
	QR/20	Portable	27×17×9	1 kW (convector) 1 kW (radiant)	Switch for fire	Steel	Warm bronze	£7 0 0	£2 11 2
	QR/30	Portable	27×21×9	2 kW (convector) 1 kW (radiant)	Switch (fire) Thermostat (convector)	Steel	Warm bronze	£8 15 0	£3 4 0
H. G. POXON ENGINEERING, LTD., 1-5, Northolt Road, Harrow, Middlesex.	1116E	Wall mounting panel	11×16×1¼	150 W	Separate thermostat	Plastic	Mottled brown	£1 8 0	£0 10 3

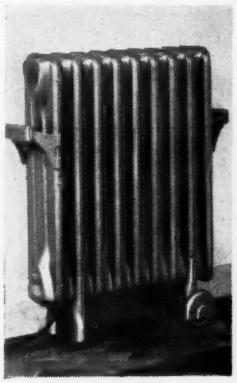


Sutcliffe & Clarkson HC/1 convector

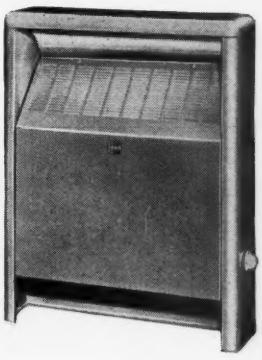


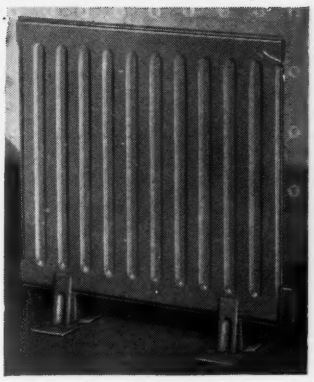


Steel Radiators panel convector and (right) oil-filled model with castors

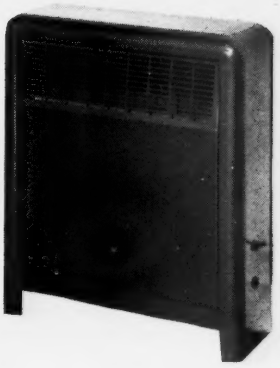


Santon column fluid-filled radiator



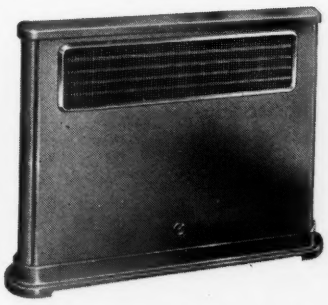


Hurseal 2 kW convector and (right) Hurseal portable panel heater

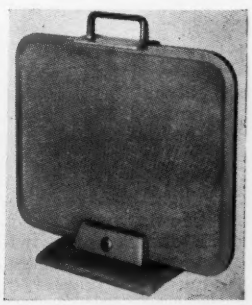


Lossos "Kaloric" cabinet convector

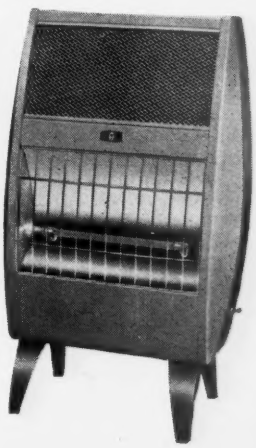
Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
H. G. POXON ENGINEERING, LTD., 1-5, Northolt Road, Harrow, Middlesex. *(continued)*	1515G	Wall mounting panel	15×15×1¼	200 W	Separate thermostat	Plastic	Mottled brown	£1 15 6	£0 13 0
	1622N	Wall mounting panel	16×22×1¼	350 W	Separate thermostat	Plastic	Mottled brown	£2 6 0	£0 17 0
SANTON, LTD., Somerton Works, Newport, Mon.	Santon	Fluid-filled column radiator	24⅜×18×6	1 kW	Thermostatic	Steel	Stone	£17 5 0	£6 6 6
	Santon	Fluid-filled column radiator	24⅜×28×6	1½ kW	Thermostatic	Steel	Stone	£23 0 0	£8 8 8
	Santon	Fluid-filled column radiator	24⅜×36×6	2 kW	Thermostatic	Steel	Stone	£26 10 0	£9 14 4
STEEL RADIATORS, LTD., Bridge Road, Southall, Middlesex.	500 W.24	Wall mounting	25½×23½×1⅝	500 W	Thermostatic	Steel	Hammered beige or cream	£10 0 0	£3 15 0
	1000 E.C.	Feet or castors	24×31×3	1 kW	Thermostatic	Steel	Hammered beige or cream	£12 13 4	£4 15 0
	1500 W.30	Wall mounting	31½×52×1⅝	1½ kW	Thermostatic	Steel	Hammered beige or cream	£16 5 0	£6 1 11
	2000 C.24	Feet or castors	24×38×5	2 kW	Thermostatic	Steel	Hammered beige or cream	£19 6 0	£7 8 6
SUTCLIFFE & CLARKSON, LTD., Whittlefield Mill, Burnley.	HCR4	Portable radiant/convector	16×13×8	2 kW	Switch for fire	Steel	Hammered bronze	£5 1 4 £3 11 2 (1 kW convector)	£1 18 0 £1 6 9 (1 kW convector)
UNITY HEATING, LTD., Chilworth Manor, Southampton.	"Cab"	Wall mounting	17½×14½×4½	1 & 2 kW	Half-heat switch above 1 kW	Steel	Aluminium, bronze, cream, green or grey	£13 0 0 (1 kW) £13 10 0 (2 kW)	£4 14 11 (1 kW) £4 18 7 (2 kW)
	"Conp"	"Floodwarmth" portable	24×27×5	1 kW	Switch or thermostat	Steel	Aluminium, bronze, cream, green or grey	£11 0 0 £12 5 0 (with thermostat)	£4 0 4 £4 9 5 (with thermostat)



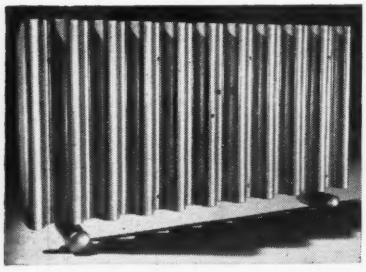
M.E.M. "Memvair" 2 kW convector and (right) M.E.M. "Circulair" portable heater



Morphy-Richards RP/10 portable heater and (right) Morphy-Richards QR/20 radiant/convector

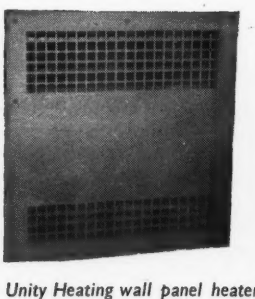


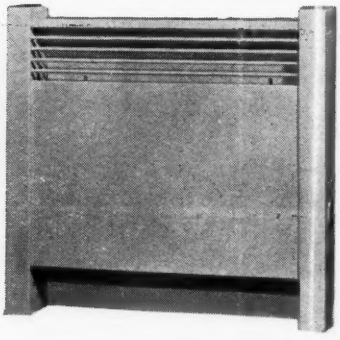
LOW TEMPERATURE HEATERS . . . . . *continued*



Yelsen 1½ kW low temperature radiator

Right: Willectric Thermall Co.'s Mark V 1 kW heater





Unity Heating wall panel heater and (right) Unity Heating "Conp" convector

Manufacturer	Name or Model	Type	Size (H.W. & D.) in inches	Element Loading	Method of Control	Casing	Finish	Price (excl. tax)	Purchase Tax
UNITY HEATING, LTD., Chilworth Manor, Southampton. *(continued)*	"Conp"	"Floodwarmth" portable	24×27×5	2 kW	Two-heat or thermostat	Steel	Aluminium, bronze, cream, green or grey	£11 15 0 £13 0 0 (with thermostat)	£4 5 10 £4 14 11 (with thermostat)
	"Conp"	"Floodwarmth" portable	28×30×5	3 kW	Two-heat or thermostat	Steel	Aluminium, bronze, cream, green or grey	£13 0 0 £14 5 0 (with thermostat)	£4 14 11 £5 4 0 (with thermostat)
	"Wode"	"Floodwarmth" portable	23×29×6	1½ kW	Thermostatic	Wood	Natural oak or mahogany	£15 0 0	£5 9 6
	1951 and 1952	Inset wall panel	23⅜×24½ (panel) 20⅜×19¾×5 (recess)	1 & 2 kW	Separate thermostat	Steel	Bronze, cream, green or grey	£14 10 0 (1 kW) £15 5 0 (2 kW)	£5 5 10 (1 kW) £5 11 4 (2 kW)
	1812, 1813, 1823, 1824 and 1836	Wall mounting panels	12×24×1½ to 30×66×1½	100 W to 1 kW	Separate thermostat	Steel	Bronze or silver grey	£7 15 0 to £19 5 0	£2 16 6 to £7 0 6
	1863 to 1866 and 1893 to 1896	Skirting board panels	6×18×1½ to 6×72×1½ and 9×18×1½ to 9×72×1½	60 W per foot run	Separate thermostat	Steel	Bronze or silver grey	£7 10 0 to £11 15 0	£2 11 1 to £4 5 9
WILLECTRIC THERMALL CO., LTD., 11a, East Cliff, Dover, Kent.	Mark V	Portable	18½×12×8½	1 kW	—	Steel and aluminium	Fawn polychromatic enamel	£5 5 0	£1 12 6
YELSEN, LTD., Ruxley Corner, Sidcup, Kent.	601	Wall mounting or portable	28×25×8	¾ kW	Thermostat and pilot light	Alloy	Epicote stoved enamel bronze	£10 10 0	£3 15 10
	603	Wall mounting or portable	28×34½×8	1 kW	Thermostat and pilot light	Alloy	Epicote stoved enamel bronze	£13 10 0	£4 17 6
	606	Wall mounting or portable	28×54¾×8	1½ kW	Thermostat and pilot light	Alloy	Epicote stoved enamel bronze	£17 10 0	£6 6 4
	610	Wall mounting or portable	28×75½×8	2 kW	Thermostat and pilot light	Alloy	Epicote stoved enamel bronze	£21 10 0	£7 15 3

Gauging Fine Wires

AN instrument for gauging wires only a fraction of a thousandth of an inch thick—much thinner than a human hair—has been designed and built at the National Physical Laboratory. The Laboratory expects it to find many applications in industry.

Many everyday things like electric light bulbs, cathode ray tubes and so on as well as scientific instruments such as Geiger counters use thin, precisely dimensioned wires. The filament inside a radio valve, for example, may be less than a thousandth of an inch thick but its diameter must be correct to a few millionths of an inch. The N.P.L.'s instrument gauges wires as thin as this with an accuracy of ten millionths of an inch or better. Not only can the wire be checked all along its length, but it can also be rotated to ensure that it is circular.

The device employs the well-established N.P.L. principle of converting distance into angle and measuring it with an "auto-collimator." This is a special telescope containing an illuminated scale which can be seen directly in the eye-piece superimposed on its reflection from a mirror. When the mirror turns, the scale and its reflection separate so enabling the rotation of the mirror to be measured to better than one second of arc.

Interested firms are invited to write for more details to Mr. I. G. Morgan, Metrology Division, National Physical Laboratory, Teddington.

British Railways Modernization

Use of A.C. Traction Forecast

ON 6th October Mr. J. C. L. Train, a member of the British Transport Commission, gave an address to the British Railways (Western Region) London Lecture and Debating Society on the modernization plan for British Railways announced earlier this year.

In the course of his address he discussed the electrified systems at present in use in this country and those contemplated for further extensions of electrification. The Southern Region system using 750 V d.c. with a third rail had been well tried over a period of 40 years and was well suited for its special and limited purpose, the operation of multiple-unit passenger trains, both local and express at frequent intervals. It was cheap to install but owing to gaps in the conductor rail at junctions, could only be used on multiple-unit trains.

The Manchester-Sheffield-Wath electrification was the first main line scheme in this country to embrace both express passenger trains, local multiple-unit trains and freight and mineral traffic. They were now getting much more work, in the shape of ton-miles of movement, out of both train crews and locomotives than was ever possible with steam traction.

Referring to the major extensions and new main line schemes proposed under the modernization plan, he said that serious consideration was being given to the use of 50 c/s alternating current taken straight from the grid at 25,000 or 6,600 V. This would require a comparatively small number of substations: for instance, on the Southern Region, using 750 V d.c., substations were on average four miles apart, on the Manchester-Sheffield route at 1,500 V d.c. they were 6·2 miles apart but using a.c., for the whole of the lines from London to Liverpool, Manchester and Birmingham, only some dozen substations would be required. Other advantages were a much less complicated distribution system and a conductor wire of much smaller cross-section, enabling the whole of the supporting structures and catenary wires to be lightened and reduced in cost.

He quoted the experience of the French railways on the system between Valenciennes and Thionville which had shown that the power characteristics of a.c. electric locomotives were superior, weight for weight, to those of d.c. locomotives. As far as could be seen at present the only real drawback to the use of a.c. was the fact that the high-voltage conductor wire required an appreciably greater clearance from earthed structures than was the case with lower-voltage systems. If extensive a.c. electrification were adopted in Britain the Transport Commission would have to face a larger programme for the reconstruction or alteration of bridges, tunnels, etc.

Mr. Train also thought that future policy would be to avoid mixed steam-and-electric or steam-and-diesel working wherever possible and to change over in whole areas of the country to either electric or diesel traction.

Science and Human Progress

AS the theme of his address as chairman of the North-Western Centre of the Institution of Electrical Engineers, Mr. G. V. Sadler chose ethical aspects of electrical engineering progression. While the creation of wealth by continuous human endeavour was laudable, he said, there was not necessarily a technical solution to every human problem, and if such endeavour were at the expense of freedom and liberty it was but a travesty of human nature.

To measure progress in terms of output alone, e.g. kW per head of world population, was not to measure the progress of real civilization, which was concerned not only with mind and body but with things of the spirit as well. Looking back over the past 2,000 years, he showed that science had roots and ordered progress dating from the earliest times and sprang from ideas about nature.

The view that history repeated itself in endless cycles was prevalent until the coming of Christianity gave direction and purpose to ideas. Scientific thought then developed away from Greek philosophy towards the Church, by which it was fostered in the belief that it provided a better understanding of scripture. Gradually a new interest in the study of nature for itself arose, not among scholars but in the carving and painting of plants and animals in the decoration of cathedrals. That was the true beginning of modern science, separated from ecclesiastical influence. Another factor was the work in science and mathematics of the Arabs in the twelfth century. Galileo (1564-1642), often described as the first scientist of the modern age, made the first deliberate attempt to replace Aristotle's theories of the mechanics of motion. With Newton and his theories of gravitation and planetary motion, further developed by Laplace at the end of the eighteenth century, the gulf between science and theology became progressively wider.

Civil and mechanical engineering was practised in India, China and Egypt in very ancient civilizations, but not until the sixteenth and seventeenth centuries did ordered progress of science and engineering really begin in Europe. Modern electrical engineering dated from Faraday. Three developments in physics later in the last century did much to discredit Newtonian and Galilean theories of the universe. These were the electromagnetic theory of radiation, the theory of relativity and the quantum theory. The origin of the failure of science and engineering in the industrial revolution to contribute to civilization in its widest sense could be traced to the coincidence of the upsurge of material prosperity during the Renaissance with the upheaval in religion due to the Reformation. The result was that the progress of technology moved away not only from religion but also from the classical arts, and there was a tendency towards a cult of engineering worship.

Members of the Institution should give thought to bridging the gulf between technology and the humanities. Individually, their powers might be limited, but they could do much towards husbanding and developing the material resources of the world for the benefit of future generations and of the under-developed countries, at the same time teaching their peoples the way to live as well as technology, but bearing in mind that their social structures were unprepared for industrial change.

Fuel Efficiency Exhibition

SPEAKING at the official opening of the 1955 Fuel Efficiency Exhibition at the City Hall, Manchester, last week, Sir Miles Thomas (chairman, B.O.A.C.) stressed the fact that though the whole field of power supply will be revolutionized when the forces of atomic energy have been fully harnessed for peaceful purposes, the country's immediate problem is to obtain more production from existing sources of power.

The electrical industry's important contribution to achieving the most efficient utilization of the country's fuel resources is demonstrated not only by the exhibits of several individual firms and the British Electrical Development Association but also by impressive displays arranged by the Central Electricity Authority and the United Kingdom Atomic Energy Authority.

Under the title "Power from the Atom," the last-named authority demonstrates the steps by which power created in nuclear fission is to be transformed into electricity in the atomic power stations. Models are shown of the first stations of this kind which are now being built at Calder Hall and Dounreay in the North of Scotland. A nuclear reactor model is also to be seen on the Central Electricity Authority's stand where the subject of smoke abatement is dealt with. The contribution of pulverized fuel firing to fuel efficiency, the work of chemists in power stations, the methods of training stokers, railway electrification and the use of television in boiler flame research are among other examples of the work carried out by the C.E.A.

Electricity and Productivity

The theme of the E.D.A. exhibit is "Electro-Heat Improves Productivity in Industry." Demonstration models are shown of a Bastian & Allen electrode boiler, a G.E.C. infra-red paint dryer, and a Fielden electronic moisture controller for textile sizing. Other examples of equipment on this stand include an electrically warmed valve for inclusion in a pipe-line, an induction heated platen, a set of electrode soldering jaws and an ultrasonic soldering iron. The stand is provided with a John Sargrove automatic daylight-controlled lighting system in which a false ceiling is fitted with louvres which close at intervals to simulate fading daylight, causing a photo-electric cell and relay to switch on artificial lighting. Light meters indicate the intensity of illumination. Among other exhibits are a model layout of an electric floor warming installation and block storage heaters.

One of the functions of the Fuel Research Station of the Department of Scientific and Industrial Research is to study the problems of atmospheric pollution. A selection of instruments used in this work is displayed including deposit meters, daylight meters and a new instrument which not only measures deposits but indicates the direction from which the pollution has come. There is also an automatic smoke meter for the measurement of the amount of pollution present in the air. A working model of a flue-gas scrubber is shown; this equipment has been produced by Simon Carves, Ltd., in co-operation with the C.E.A., and is designed to remove the large quantities of sulphuric compounds to be found in flue gases from power station boilers before the gases reach the open air.

Babcock & Wilcox, Ltd., occupy a composite stand together with their associated companies, Edwin Danks & Co. (Oldbury), Ltd., and Spencer-Bonecourt-Clarkson, Ltd. Items of particular interest include the "Steambloc" oil-fired packaged boiler and special attention is drawn to its value in meeting "smokeless zone" regulations. The importance of clean boilers for efficient operation can hardly be over-emphasized and a large display is devoted to this question, including a new method of sootblower operation, the Babcock "Unidirectional" retractable model, now available for pneumatic operation.

An interesting range of electrical products displayed by Ferranti, Ltd., includes moving coil voltage regulators, static balancers, maximum demand alarms and a working unit incorporating a p.f. correction capacitor and meter. This demonstrates the effect of power factor improvement in reducing electricity costs and improving operating efficiency and voltage regulation of distribution systems.

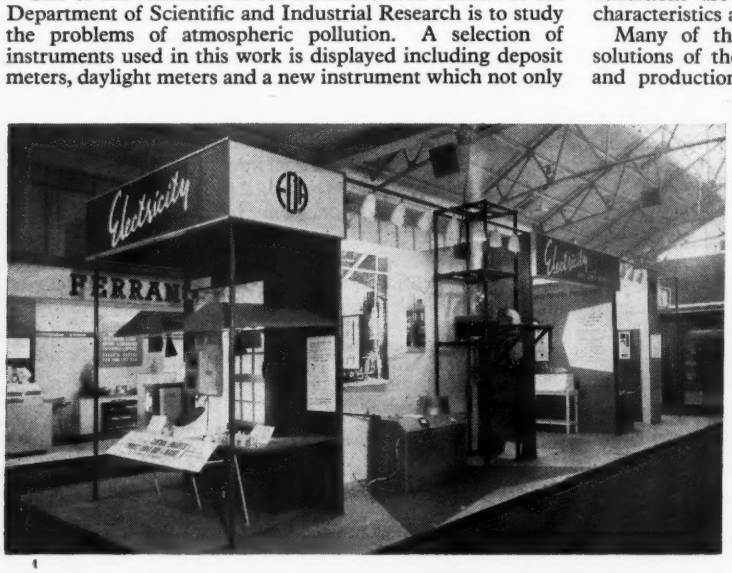
The Metropolitan-Vickers exhibit takes the form of a working model of unified boiler control as applied to a chain grate stoker fired boiler. There is also a series of curves comparing the efficiency of unified boiler control and other control systems, and a number of photographs illustrating actual installations. A working model of a 9,000 h.p. geared Ward-Leonard Ilgner winder based on equipment for the National Coal Board (N.W. Division) is also shown.

A comprehensive display of "Satchwell" temperature controls shown by the Rheostatic Co., Ltd., includes the new "DS" automatic oil-burner control, a small self-contained unit suitable for mounting on the flue of a boiler, providing automatic operation and all the requisite safety features. The complete unit contains a change-over switch actuated by the flue element, 4-pole motor relay, 3-pole thermal purge switch, lock-out switch, transformer to supply the two thermal delay switches, combined lock-out reset button and signal lamp and terminal block. "Satchwell" compensators for heating control in accordance with prevailing conditions are shown in their new form with improved characteristics and adjustments.

Many of the exhibits of Radiovisor Parent, Ltd., are solutions of the fuel economy problems which beset plant and production engineers. The company's photo-electric industrial smoke density indicator, for example, is an effective means of reducing wasteful combustion by giving instantaneous warning of excessive smoke emission. To meet the needs of smaller users the Radiovisor smoke alarm is available; this also provides audible or visual alarm and is particularly suitable for small factories, blocks of flats, etc.

Fibreglass, Ltd., demonstrate by means of models and photographs how fuel may be saved and better conditions obtained by the insulation of factory roofs, internal and external pipes, boilers and ovens.

The exhibition remains open until tomorrow (Saturday) evening.



Section of the British Electrical Development Association's stand at the Fuel Efficiency Exhibition

GENERATION AND DEVELOPMENT

Large Plant Increase in September

Last month there was a net increase in generating plant capacity of 322 MW, making the total added so far this year 911 MW. As shown in the table below, the aggregate capacity in generating stations of the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board at 30th September was 21,478 MW. Plant commissioned by the C.E.A. last month included the following:—

Goldington: 30 MW B.T.H. turbo-alternator and 300,000 lb/hr Clarke, Chapman boiler. Drakelow "A": 60 MW English Electric set and 515,000 lb/hr International Combustion boiler. Fleetwood: 30 MW English Electric set. Acton "B": 30 MW Richardsons, Westgarth set. Brighton "B": 52·5 MW Richardsons, Westgarth set. Carmarthen Bay: 60 MW Metropolitan-Vickers set and 240,000 lb/hr Babcock & Wilcox boiler. Clarence Dock: 250,000 lb/hr B. & W. boiler. Connah's Quay: 30 MW Parsons set. Huncoat: 30 MW G.E.C. set. Littlebrook "C": 360,000 lb/hr International Combustion boiler.

For the nine months of the year up to the end of September the average rate of rise in electricity generated was 9·8 per cent, the high figures recorded in the early part of the year having been modified by the lower percentages in the unusually warm and dry summer months; in the third quarter the monthly averages were 2·9, 5·5 and 6·6 per cent.

Cookers in Aberdeen Houses

A move by the Finance Committee of Aberdeen Town Council to discontinue supplying gas and electric cookers to the tenants of municipal houses—which is estimated to cost the Corporation at least £10,000 a year—was narrowly defeated at a recent meeting of the Town Council. The Committee had recommended that the supply of cookers should be discontinued from 28th November.

Supporting the Committee's recommendation, Councillor T. Scott said it seemed ridiculous that they should be supplying non-heritable fixtures to the tenants. Some might not be able to afford to buy the cookers, but they could get them on hire-purchase as other people did. No other builders provided cookers.

Bailie J. P. Cosgrove said that the Corporation were supposed to be model landlords. A house was not just the barest minimum they could get away with. Councillor N. Hogg claimed that proper cooking facilities were an integral part of any home.

By 15 votes to 12 it was decided to continue the present practice of supplying cookers.

Helicopter Solves Transport Problem

In Austria, a region known as the Malta Valley has recently become the scene of a large new civil engineering project which includes the building of a dam high up in the mountains across the valley and the construction of a power station. To determine the suitability of the sub-strata at the chosen site for the dam, heavy drilling equipment had to be carried up through the rugged valley to a height of 6,000ft. For six months attempts were made to transport the equipment by porters and donkeys but, in the roadless, rocky valley, the obstacles were so great that the attempts were abandoned.

It was then decided to try using a helicopter as an aerial crane and a machine was chartered from Autair, Ltd., Croydon. This particular operation was conducted by the European associate company, Overseas Aviation.

Some 20 tons of equipment had to be transported up to the head of the valley and, to enable the helicopter to lift the heavy machine parts and drill tubes which were too large to go into the cabin, a toughened nylon net was rigged to the specially fitted load-carrying beam beneath the machine. Captain L. Lord, Autair's chief pilot, then flew a shuttle service between the base at the foot of the valley, to which the equipment was brought by truck, and the dam site high in the mountains. The helicopter was also used for transporting engineering personnel in the area and for aerial survey. The whole operation involved making some 50 return flights, each of approximately 30 minutes' duration, to the mountain top and was completed in less than two weeks.

The helicopter climbs rapidly on its way to the Austrian dam site 6,000ft higher up in the mountains. The drill tubes are carried in the toughened nylon net below the machine

I.O.M. Commission's Recommendations

The appointment of a single electricity authority in the Isle of Man is recommended in a report by Sir William Robinson and Mr. W. J. Girvan who in November, 1953, were appointed by the Governor as a Commission to investigate the operation of the island's electricity supply system. Sir William Robinson was chairman of the Electricity Board for Northern Ireland up to 1952 and Mr. Girvan was formerly city electrical engineer of Belfast. The report also recommends that an additional 2,000 kW diesel set should be installed at the Peel station for service in 1957. No further capital expenditure should be incurred, except in special circumstances, other than that required for normal distribution development throughout the island.

By vesting the two existing undertakings—the I.O.M. Electricity Board and Douglas Corporation Electricity Department—in one authority it is estimated that there would be joint savings amounting to £17,000 in 1956,

ELECTRICITY GENERATED AND PLANT INSTALLED*

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity Authority ...	2,936	52	11·0	5,504	4	5,514	5,166	19,604
N. of Scotland H.E.B.	30	—	1·2	45	31	81	78	623
S. of Scotland E.B.	207	6	—	388	5	393	371	1,251
Total for September, 1955 ...	3,173	58	12·2	5,937	40	5,988†	5,615	21,478
Corres. total for September, 1954	2,933	85	17·6	5,474	133	5,617	5,279	19,815
Inc. or dec. as a percentage of 1954	+8·2	−31·8	−30·7	+8·5	−69·9	+6·6	+6·4	+8·4
Total to date (9 months) 1955 ...	30,084	791	161·5	56,499	825	57,443	53,972	
Total for corres. 9 months of 1954	27,809	824	110·5	51,188	1,023	52,316	49,175	
Inc. or dec. as a percentage of 1954	+8·2	−4·0	+46·2	+10·4	−19·4	+9·8	+9·8	

* Comprising all generating stations controlled by the Central Electricity Authority, the North of Scotland Hydro-Electric Board, and the South of Scotland Electricity Board.
† The total figure includes generation by other methods amounting to 11 million kWh.

rising to £24,000 in 1960. A similar recommendation for a single authority was made by the Nimmo Commission in 1948 but was not acted upon.

The Legislative Council of the island has passed through all its stages a Bill empowering the I.O.M. Electricity Board to borrow £63,000 to pay the compensation awarded to Douglas Corporation for expenses incurred in installing additional generating plant at the Pulrose station to meet the Board's requirements.

European Power Station Plant

The eighth survey of "Heavy Power Station Equipment," made by the Organization for European Economic Co-operation, is now available from H.M. Stationery Office at 3s 6d. The document is concerned mainly with deliveries and orders as at 1st April, 1955, which are compared with those for the previous twelve months and with those scheduled for the current year. Deliveries were on an average 10 per cent in arrears, but no attribution is made to individual countries. For the first time since 1948 consignments of power transformers did not exceed those for the preceding twelve months.

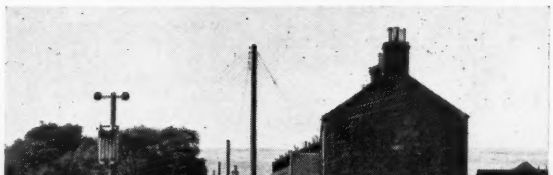
Expectations for 1955-56 are that the combined thermal and hydraulic generating capacity to be installed will be 30 per cent more than that for the past year and will surpass all post-war delivery peaks except as regards medium size boilers and hydraulic turbines. New orders received during 1954-55 for delivery within the next four years have substantially increased the total orders in hand, although those for power transformers dropped for the first time since 1951. There is no change in maximum ratings of hydraulic plant on order, but much larger thermal units with higher steam ratings are being built for overseas countries as well as the seventeen member countries that manufacture them. Nevertheless nearly 75 per cent of all alternators for thermal plants this year will be installed in the producers' own countries as against 60 per cent in 1950.

Electricity supply authorities, although basing their own development programmes on long-range plans, tend to place their orders late. This necessitates manufacturers organizing their work at short notice at a high level of output without assurance that subsequent orders will require its continuance on the same scale. This tendency, in addition to retarding deliveries, often makes it difficult to procure materials and accentuates price fluctuations.

Maximum ratings of generating units manufactured or under construction in member countries are as follows: steam turbines, 250 MW (Germany); boilers, 2,204 klb/hr, 5,120 lb/sq in and 1,157 deg F (Switzerland); hydraulic turbines, 150 MW (Germany); transformer, 309 MVA (United Kingdom).

Supply to Riccarton

As briefly reported in our last issue, an electricity supply provided by the South of Scotland Electricity Board was formally inaugurated at Riccarton, a remote village in the hills above Liddesdale, Roxburgh, on 28th September. Riccarton has no access by road. To provide the supply a 1½-mile long spur line on wood poles was teed-off an 11 kV single-phase line near Pinglehole Bridge, and was taken up the mountainside and across the intervening hills to Riccarton village. The construction of the new line was carried out by British Insulated Callender's Construction Co., Ltd. Unusual methods had to be used in getting the materials to site as it was not possible to use any form of wheeled transport on the last stages. The poles were dragged up the hillside by horses, and other overhead line material was conveyed on horse-drawn sledges.



Termination of 11 kV line into Riccarton Junction, Roxburgh. This hamlet has no approach road

New Ontario Project

Construction of a hydro-electric generating station at Whitedog Falls on the Winnipeg River has been authorized by the Ontario Hydro-Electric Commission to meet the growing power needs of Ontario's north-western area. The plant (capacity approximately 71,700 h.p.) is scheduled for service at the end of 1957. A 115 kV transmission line will link the station with the Commission's North-Western Division network through a new transformer station at Kenora.

Sodium Lighting in Canada

Canada's second major sodium street lighting installation is now in operation along the new Angus L. Macdonald suspension bridge which spans the mile across Halifax Harbour between Halifax and Dartmouth, Nova Scotia. The lanterns were supplied by the British General Electric Co. (Canadian), Ltd. There are sixty G.E.C. enclosed main road lanterns with auxiliary equipment and 140 W sodium lamps.

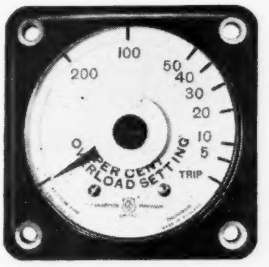
The British General Electric Co. (Canadian), Ltd., also supplied the lanterns for the first comprehensive installation of sodium street lighting in Canada, to light the streets surrounding the civic centre of the City of Kelowna, British Columbia. They consist of forty-two G.E.C. enclosed main road lanterns with 140 W sodium lamps and auxiliary equipment, at a mounting height of 25ft with 110ft between fixtures. To create a contrast, the floodlighting of Kelowna City Hall at the centre of the sodium lighting scheme is carried out by two banks of lights, each consisting of two 400 W mercury lamps and one 140 W sodium lamp.

Resembling a Swiss chalet, this hydro-electric station near Lütschental is an attractive example of design in keeping with the surroundings. The photograph was taken by Mr. P. D. A. Oliver, secretary of the C.E.A. Southern Division, during a holiday in Switzerland

NEW ELECTRICAL EQUIPMENT

Overload Protection Device

An inexpensive device which affords reliable overload protection for electrically driven machines has been developed by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2. Basically, it consists of a sensitive ammeter which is provided with a pair of contacts that close at full-scale deflection to operate an external relay. This relay can be utilized to operate a warning system or a mechanism which will stop a machine's operation. The instrument



Crompton contact making ammeter

is usually supplied with a dial calibrated in "percentage overload setting" to give a visual indication of the overload which will cause the contacts to close.

In use the instrument is connected to the secondary winding of a variable ratio current transformer, the primary of which is connected to take the operating current of the machine being controlled. By hand adjustment of the current transformer, the ammeter can be set to the appropriate overload value, thus avoiding the use of an adjustable contact in the instrument.

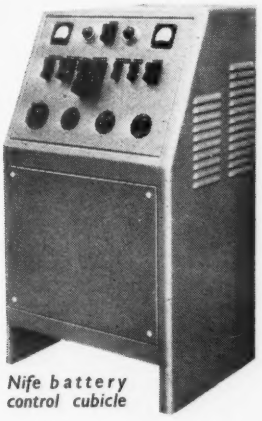
A typical application for the device is in the automatic control of deep drilling machines and other applications are to be found in the machining of various modern alloys, particularly those which are notorious for causing tool fatigue. In such cases, tool fatigue is accompanied by a rapid deterioration in the work and it would be the purpose of the ammeter to indicate when the resulting increase in operating current became unduly serious.

Battery Control Cubicle

A new control cubicle has recently been added to the range of emergency lighting equipment made by NIFE BATTERIES, of Redditch, Worcestershire. It is being supplied with the "Nife-Neverfayle" emergency lighting units for pilot systems where the lamps are illuminated only on mains failure, and for change-over systems where the lamps are normally fed from the a.c. supply and automatically transferred to the battery on mains failure.

The battery, which is of the nickel-cadmium-alkaline type, is mounted separately on a single tier stand, the space occupied being approximately one-third that of conventional equipment. Being of the alkaline type, the battery does not require a special battery room.

Operation of the contactor in a positive manner and within close voltage limits is achieved by means of an automatic control device incorporating an auxiliary relay for switching in and out the economy resistance.



Nife battery control cubicle

The relay is set so that it will not close until the mains voltage is higher than that required for a positive closure of the contactor, thus eliminating the danger of burning out the contactor coil or its associated auxiliary rectifier.

Also contained in the control cabinet is a vacuum impregnated double wound transformer with tapped primary and full-wave bridge-connected selenium rectifier for recharging a discharged battery in 14 hours.

"Ter-mate" Terminal Pins

An interlocking terminal pin, any number of which can be locked together to form a composite terminal block of any desirable shape, has been introduced by ELECTRIC REPAIRS (NOTTINGHAM), LTD., Elson Street, New Basford. On the underside of each unit block opposite the fixing lug is a slot which fits into the next terminal block, so becoming interlocked. After the first terminal unit has been fixed with a countersunk screw and providing there are not too many ways, no other fixing is required until the last block is screwed down, only this last screw being visible.

The units are produced with terminal studs in three sizes, namely 0, 2 and 4 B.A., with or without barriers. The 0 B.A. size is on a $\frac{7}{8}$in square base, the 2 B.A. on a $\frac{3}{4}$in and the 4 B.A. is on a $\frac{5}{8}$in square base.

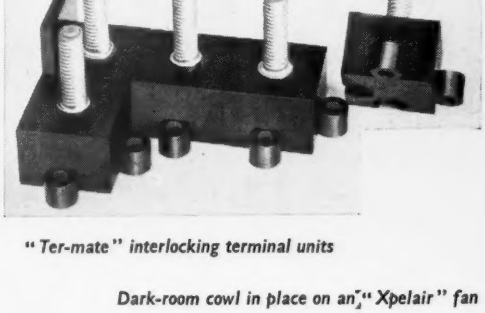
Plastic Impeller and Blackout Cowl

A new moulded plastic impeller has been developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, for the company's 7½in "Xpelair" window fan. The moulded blade prevents amplification of any magnetic noise which may be present in the motor at certain speeds.

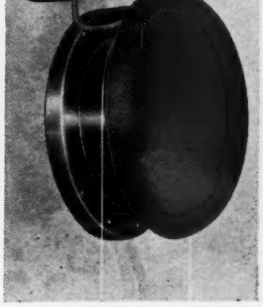
At the same time a lightproof attachment has been produced for both the 7½in and 9½in diameter "Xpelair" fans so that they may be used in X-ray and photographic darkrooms. The attachment consists of an aluminium blackout cowl which can be fitted over the bell-mouth entry of the fan. This cowl excludes light completely without seriously reducing the extraction rate.

The iris shutter available with some models is another device which is invaluable where photographic darkrooms have to be ventilated. This shutter completely closes the fan orifice when the fan is switched off; there is thus no possibility of backdraught depositing dust on plates or films being developed, or lowering of room temperature and so cooling the solution tanks.

The price of the "Xpelair" darkroom cowl ready for fixing is £1 18s 6d for the 7½in diameter size and £2 11s for the 9½in diameter size.



"Ter-mate" interlocking terminal units



Dark-room cowl in place on an "Xpelair" fan

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets await the reassembly of Parliament and the details of the further measures which the Government intend to introduce for the strengthening of the economy. In the interval, the ability of the gilt-edged market to maintain its new found ascendancy over industrial ordinary shares became less marked. Government securities encountered some profit-taking after the uncommonly rapid and sharp advance in the earlier part of this month. In the industrial market, the severity of the fall in prices began to interest bargain hunters.

Extent of the Damage

With industrial shares managing now to recover at least a temporary footing, the following comparisons are made to illustrate the steepness of the decline which has taken place in the three months elapsed since markets began to take seriously the deterioration in economic affairs, together with the effects of the credit squeeze and the other Government measures adopted to deal with it:

Ord. Share	Mid-July	Mid-Oct.	Fall
A.E.I.	96/-	77/6	18/6
Auto Tel. ...	74/-	62/6	11/6
Babcock & Wilcox	97/-	77/6	19/6
B.I.C.C.	55/-	45/-	10/-
Brush	9/3	7/6	1/9
E. K. Cole ...	25/-	20/3	4/9
Cossor	13/3	9/3	4/-
Crompton Parkinson	19/-	15/6	3/6
Decca	45/6	36/3	9/3
E.M.I.	30/6	26/-	4/6
G.E.C.	76/6	60/-	16/6
I.C.I.	56/3	46/3	10/-
Lancs. Dynamo ...	56/3	43/9	12/6
Lucas	55/-	43/9	11/3
Parsons	95/-	75/-	20/-
Plessey	87/6	66/3	21/3
Reyrolle	125/-	95/-	30/-
Tube Investments	105/-	90/-	15/-
Westinghouse ...	108/9	85/-	23/9

Electrical Equipment Shares

While some of the above falls have exceeded the average depreciation of the past quarter, it remains the case that many electrical shares have done relatively well in maintaining values some way above those ruling at the start of the year. In other words, the previous rises also went exceptionally far, and the extent of the relapse may probably be regarded in large measure as a correction of unmeasured enthusiasm about the possibilities opened up by the new nuclear power and electronic discoveries. Another factor would be the changed disposition of investors towards shares displaying low yields on the basis of current dividends. People have become noticeably less inclined to discount dividend prospects now that these may be affected by the workings of the credit squeeze upon the financial resources of industry, apart from anything the Chancellor may have to say on the subject.

Interim Dividends

Richardsons Westgarth are departing from custom in declaring an interim dividend of 6¾ per cent for the current

The Week's Price Changes

Company or Board	Nom. Value	Middle price 17th Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	81⅛		3	3	3 13 10	94⅜	76⅛
Brit. Elec. 1974/77	100	80⅛	+⅛	3	3	3 14 6	93⅞	75⅛
Brit. Elec. 1976/79	100	84½	+1	3⅛	3⅛	4 2 10	98⅜	80⅛
Brit. Elec. 1974/79	100	95½		4⅛	4⅛	4 16 0	109	90½
Overseas Electric Supply								
Calcutta Elec.	£1	22/-		6†	6†	5 9 0	22/6	20/9
East African Power	£1	20/-		7	7	7 0 0	24/6	19/9
Nigerian Elec.	£1	21/-		10	10	9 10 6	27/-	21/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	22/9	21/-
Perak Hydro-Elec.	£1	22/3	+9d	10	10	8 19 9	22/3	17/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/-	+6d	12½	17½	—	14/6	11/-
Aerialite	1/-	6/-		88⅛	88⅛	—	6/7	5/3
Allen, W. H.	£1	75/-		20	20	5 6 9	83/9	75/-
Aron Elec. Ord.	£1	57/6	−2/-	15	15	5 4 3	63/9	55/6
Assoc. Elec. Ord.	£1	77/6	+2/6	11¼	14	3 12 3	96/-	62/6
Automatic Tel. & El.	£1	62/6	+2/6	15	15*	4 16 0	79/6	60/-
Babcock & Wilcox	£1	78/9	+3/9	12*	15	3 16 0	98/-	68/6
Baldwin, H. J.	2/-	4/9		20	20	8 8 6	5/6	4/4
Bakelite	10/-	31/6		12½	16	5 1 6	34/6	27/-
British Aluminium	£1	48/-	−9d	10	12	5 0 0	58/-	35/3
B.I. Callender's	£1	45/-		10	10	4 9 0	55/3	44/9
B.I. Callender's 6% Pref. ...	£1	23/6	+1/9	6	6	5 2 2	26/6	21/9
British Thermostat	5/-	30/-		27½	27½	4 11 9	35/-	22/6
British Vac. Cleaner	5/-	6/9		25	30	—	10/-	6/9
Brook Motors	10/-	44/6		20	20*	4 10 0	46/3	39/9
Brush Ord.	5/-	7/6		6	10	6 13 3	9/6	7/6
Bulgin, A. F.	1/-	6/9		30	45	6 13 3	8/-	4/-
Burco Dean	5/-	12/6	−3d	—	—	—	17/3	12/6
Chloride El. Storage	£1	67/-	+5/9	12½	17½	5 4 6	77/6	58/6
Clarke Chapman	£1	92/6	+2/6	20	20*	4 6 6	102/6	68/9
Cole, E. K....	5/-	20/3	+9d	27½	17½*	4 6 5	25/6	18/3
Cossor, A. C.	5/-	9/3	+6d	10	15	8 2 3	14/-	8/9
Crabtree	10/-	27/6	−1/-	17½	20	7 5 6	34/6	27/6
Crompton Parkinson Ord. ...	5/-	15/6		20	20	—	19/9	16/-
De La Rue	5/-	18/-	+1/-	20	30	8 6 9	26/-	17/-
Decca	4/-	36/3	+1/9	35	56¼*	—	48/9	31/-
Desoutter	5/-	31/3	−2/6	20	25	4 0 0	35/-	25/6
Dewhurst	2/-	10/-		19	24	4 16 0	10/6	7/3
Dictograph Tel.	2/-	7/6		20	20	5 6 9	9/3	6/6
Dubilier Condenser	1/-	4/6	+3d	25	25*	5 11 0	5/7	3/1
E.M.I.	10/-	26/-	+6d	8	10	3 17 0	37/-	25/3
Electrical Components	5/-	15/-		20	25	8 6 9	21/3	15/-
Elec. Construction	£1	30/9		15	8½*	5 10 6	41/3	30/9
Enfield Cable Ord.	£1	20/-		Nil	Nil	Nil	25/3	20/-
English Electric	£1	60/6	+6d	10	12½	4 2 8	86/9	54/3
English Electric 3¾% Pref.	£1	14/-		3¾	3¾	5 7 3	16/9	14/-
Ericsson Tel.	5/-	38/3	+9d	25†	25†*	3 5 4†	46/6	29/-
Ever Ready	5/-	28/6		40	35*	6 2 9	38/-	22/3
Falk Stadelmann	£1	46/6	−1/-	15	15	—	52/6	42/-
G.E.C. Ord.	£1	60/-		12½	14	4 13 3	80/3	51/3
G.E.C. 6½% Pref.	£1	23/9		6½	6½	5 9 5	28/4	23/6
General Cables	5/-	15/9		30	30	9 10 6	17/-	15/-
Greenwood & Batley	£1	52/6		17½	17½	6 13 4	57/6	52/6
Hackbridge Cable	5/-	20/-	−3d	20	25	6 5 0	22/6	14/-
Hackbridge & Hewittic	5/-	20/3		25	30	—	24/9	17/-
Hall Tel. Acc.	10/-	25/-	−3/9	10	10	4 0 0	28/9	11/-
Heatrae	2/-	5/-		12½	15	6 0 0	5/9	4/3
Henley's	10/-	16/3	+6d	10½	10½	6 9 3	21/3	15/9
Holophane	5/-	17/6		25	30	8 11 6	19/9	16/-

* After scrip issue. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

year. It does not go to the 1·4 million new shares successfully issued this month; they will qualify for the final distribution, which is expected to raise the total to the rate of 16⅔ per cent paid for 1954-5. The shares were firm at 15s 6d, with the new issue a fraction higher, being transferable free of stamp. Reliance-Clifton Cables' interim of 10 per cent is 1 per cent more than last year's corresponding payment; the shares were quoted at 25s 6d after the announcement. Engineering & Lighting eased to 4s after the declaration of an interim of 5 per cent on capital increased by this year's three-for-two script issue.

in Electrical Investments

Company or Board	Nom. Value	Middle price 17th Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	38/-	−5/-	45	70	9 4 3	52/6	37/-
I.C.I.	£1	46/9	+2/6	15	10*	4 5 6	61/9	38/3
Intl. Combustion	5/-	16/-		20	25	—	24/6	16/-
Johnson & Phillips	£1	39/6		15	15	7 13 10	52/6	41/-
Lancashire Dynamo	£1	43/9	−1/3	14	15	—	56/6	37/3
Laurence, Scott	5/-	15/6	−1/6	20	12½*	4 0 9	19/6	14/6
Lister, R. A.	£1	30/-		12	9·3*	6 4 0	40/-	30/-
London Elec. Wire	£1	51/3		10	12½	4 17 6	61/3	50/6
Lucas, J.	£1	43/9	+3/9	10·8	7½*	3 8 6	56/6	40/-
Marryat & Scott	2/-	10/3		25	30	5 17 0	13/-	9/6
Mather & Platt	£1	62/6	−6d	15	13·4*	—	75/-	48/-
Metal Industries	£1	27/-	−3d	9	9	6 13 4	38/-	26/6
Midland Elec. Mfg.	£1	48/9		15	10*	4 2 0	55/-	44/-
Morphy-Richards	4/-	27/6	−1/3	35	50	7 5 6	35/-	27/-
Murex	£1	60/9		15	15	4 18 9	66/-	49/3
Newman Ind.	2/-	2/9		10	10	7 5 6	3/6	2/4
Oldham & Son	1/-	2/9		17¼	20	—	3/6	2/1
Parnall (Yate)	5/-	8/3		8	14	8 9 9	13/2	7/3
Parsons, C. A.	£1	75/-		7½	10	2 13 4	100/-	56/-
Plessey	10/-	66/3	+2/6	30	20*	3 0 3	89/-	57/6
Pye Deferred	5/-	22/6	+4/-	20	12½*	2 15 6	23/9	14/3
Revo	10/-	13/-	−9d	27½	9*	6 18 6	15/6	12/6
Reyrolle	£1	95/-		13⅓	15	3 3 3	127/6	89/-
Rheostatic	4/-	12/3	−3d	20	22½	—	14/3	9/3
Richardsons Westgarth	5/-	15/6	+6d	15	16⅔	5 7 6	19/-	11/-
Scottish Cables	4/-	16/9		27½	27½	6 11 3	22/6	16/9
Smith (England), S.	4/-	15/3	+3d	15	17½	4 11 9	20/-	15/-
Southern Areas	£1	32/6		7½	10	6 3 0	38/-	27/6
Strand Elec.	5/-	8/3		17½	15*	9 1 9	13/3	7/6
Sturtevant	5/-	30/-		18·9	14·4†*	2 8 0†	35/9	21/-
Sun. Elec.	£1	35/-		15	15	8 11 6	35/-	33/9
Switchgear & Cowans	5/-	15/-		10	20	6 13 3	17/-	11/-
Taylor Tunnicliff	5/-	13/9		12½	15	5 9 0	16/3	11/3
T.C.C.	10/-	47/6		30	25*	5 5 3	53/9	41/-
T.C. & M.	£1	30/-	+9d	8½	8½	5 13 4	40/9	29/3
Telephone Mfg.	5/-	7/9		10	10	6 9 0	11/6	7/9
Thorn Elec.	5/-	19/6		20	15*	3 17 0	33/-	13/9
Thornycroft	£1	42/6		15	15	—	47/6	34/6
Tube Investments	£1	92/6	+2/6	17½	22½	—	107/6	72/6
Vactric	5/-	16/3		10	15*	4 12 3	22/-	12/-
Veritys	5/-	10/6		12½	12½	5 19 0	12/3	7/-
Wallsall Conduits	4/-	13/6	−9d	70	70	—	17/3	12/-
Ward & Goldstone	5/-	33/9	−1/3	50	30*	4 9 0	45/-	32/6
Watford	2/-	7/6		22½	25	—	8/9	6/3
Westinghouse Brake	£1	85/-	−5/-	16	18	4 4 8	110/-	82/-
West, Allen	5/-	12/9		17½	15*	5 17 8	16/6	8/-
Wolf Electric	5/-	21/-		17½	20	4 15 3	21/-	16/1
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A. Ord.	100	72½	+3	6	6	8 5 6	88	67½
Ord.	100	45		3¾	3¾	8 6 8	54½	45
Anglo-Portuguese	£1	25/-	+6d	8	8	6 8 0	27/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	20/-	+1/-	50	22½*	5 12 6	24/3	19/6
Cable & Wireless:								
Ord.	£1	41/9		9	10	4 15 9	54/-	39/6
4% Loan	100	92½		4	4	4 6 6	100	92
Calcutta Trams	£1	25/9	+6d	6†	7½†	5 16 6†	26/3	20/-
Cape Elec. Trams	£1	18/9		5½	7½	8 0 0	19/6	16/6
Marconi Marine	£1	31/3	−1/3	10	10	6 8 0	41/3	31/3
Oriental Tel. Ord.	1/-	77/6	+2/6	16	—	—	102/6	72/6
Telephone Rentals	5/-	10/9		10	12½	5 16 3	13/6	9/6

Free of Stamp

The unusually large number of recent issues in the electrical markets presents varied opportunities to the investor who likes to acquire shareholdings in the form of renounced allotment letters and free, therefore, of the usual expense of the 2 per cent transfer stamp duty. Among them, the new English Electrics are now 30s paid (with a further 30s call due 21st November) and have been available at a premium of about 6d, to yield 4·1 per cent on the basis of the present rate of dividend. Richardsons Westgarth and Murphy Radio new 5s shares, both now fully paid, have been quoted respectively at 15s 9d, yielding 5·3 per cent, and 17s 3d yielding 5·8 per cent. On Electrical Components and British Relay Wireless new shares, at all-in prices equivalent to 14s 6d and 16s, the prospective yields are 8·5 and 5 per cent.

Preference Shares

As a result of the past month's improvement in the gilt-edged market, industrial preference shares have recovered much of the popularity which they lost steadily to ordinary shares during the latter's long run of success. There is still no present difficulty in finding yields of around 5 per cent from top-grade and marketable preference stocks such as I.C.I. 5 per cents at 20s 3d, G.E.C. 7½ per cents at 29s 3d, and Ferranti "sevens" at 26s 9d. Among issues on offer recently in fair numbers yields from about 5½ to 5¾ per cent are shown by those such as the 5½ per cent preference shares of Lancashire Dynamo at 20s 6d, and Murphy Radio at 19s 3d; from Crompton Parkinson "sixes" at 21s 9d, and Ward and Goldstone "sevens" at 25s. The 6 per cent preference of Watford (10s shares) at 9s 6d, and of A. C. Cossor at 19s 3d, also the 5½ per cents of British Vacuum Cleaner, give returns of from 6 to 6½ per cent. On J. Scott 6½ per cents at 19s the yield is over 6¾ per cent.

New Issues

Allotment letters in connection with the big Tube Investments issue are due to go out on the last day of this month. Stockholders are to be offered one new ordinary share at 22s 6d (the existing shares stand at 92s 6d) for each share held. Other new issue announcements have come from Pressed Steel and Bakelite. The former are arranging an issue of 1·9 million new 5s ordinary shares, by way of rights, on a one-for-seven basis: the price is expected to be 16s. The existing shares stand at 21s 3d. Bakelite propose to finance the continuance of the expansion programme by the issue of a million 6 per cent preference shares. The meeting is being held on 8th November, and the new shares may be placed privately.

REPORTS and DIVIDENDS

H. Fisher (Oldham), Ltd.—The joint receivers of the company state that since it was decided to close the business down at the end of August and realize the assets, an offer to take over the business as a going concern has been received from Hartley Baird, Ltd. The offer, which the receivers recommend the creditors to accept, involves transferring the issued share capital to Hartley Baird free of cost and the unconditional assignment to them of at least 95 per cent of the pre-receivership unsecured creditors, the consideration being 1s in the £. Hartley Baird will discharge the preferential creditors and pay the receivers' costs and expenses. They will also discharge or make arrangements for the continuance of the existing debentures. Funds for purchasing unsecured creditors' claims, discharging the preferential creditors and meeting the receivers' expenses will be provided by the issue to the receivers of fully-paid Hartley Baird shares which will be disposed of for cash.

Permali, Ltd.—The directors are advised that the best method under present circumstances of raising new money is by an issue of convertible unsecured loan stock repayable after ten years, the interest on which is expected to be at the rate of 6 per cent per annum. The amount to be raised is £300,000 and it is proposed that the stock should be offered in the first instance to shareholders. It is also proposed that holders of the loan stock should have the right for a limited period of converting their holdings into ordinary shares on the basis of four ordinary shares of 2s each for every £1 of stock on 1st October, 1957 and 1958, and three ordinary shares of 2s each for every £1 of stock on 1st October, 1959 and 1960. It is further intended to capitalize £50,000 in a one-for-seven scrip issue. The new ordinary shares will rank *pari passu* with the existing ordinary shares including all dividends which may be declared hereafter on the ordinary capital. The consent of the Capital Issues Committee has been obtained to make the issue of loan stock and the capital distribution.

The Perak River Hydro-Electric Power Co., Ltd., reports a revenue for the year to 31st July last of £1,592,999, as compared with £1,449,571 for 1953-54, and after meeting working expenses, there is a net revenue of £910,200 (against £832,151). To this is added £106,136 brought in and £250,000 taxation over provided, making £1,266,336. Depreciation account receives £250,000, general reserve £400,000 and fuel equalization reserve £10,000. Taxation requires £340,000. It is proposed to pay an ordinary dividend of 10 per cent for the year and to carry forward £130,555. The ordinary distribution for the previous year was 10 per cent, but this included a bonus of 3 per cent, which is now consolidated in the year's dividend. Subject to Treasury consent, it is proposed to capitalize £437,500 of reserves and to issue to the ordinary shareholders one fully paid ordinary share of £1 for every four ordinary shares of £1 each held.

The Telegraph Construction & Maintenance Co., Ltd., announces that it has received Treasury consent to the issue for cash at 22s 6d per share of the remaining 68,862 ordinary shares of £1 each of the authorized ordinary share capital of £3,000,000. These will be offered to employees of the company and its associated and subsidiary companies.

Associated Electrical Industries, Ltd., has made an offer for sale of 1,050,000 shares in the newly formed company, A.E.I., Ltd., registered in Victoria, Australia. The new company has been formed to acquire from A.E.I., London, the total issued shares of the operating company, Australian Electrical Industries, Pty., which was previously known as Australian General Electric Pty., Ltd.

Richardsons, Westgarth & Co., Ltd.—Stockholders have taken up 96 per cent of the 1,415,488 shares available to them under their rights and, by way of excess applications, have also applied for 724,093 shares. Employees, in some instances applying as existing shareholders, have taken up a total of 38,724 shares. Excess applications for up to 100 shares have been allotted in full; other applications have been scaled down accordingly.

An interim dividend is to be paid on the £1,769,360 ordinary capital of 6⅔ per cent. This is the first interim to be declared since 1943-44 when 4 per cent was paid on £1,061,616. For the year to 31st March last the dividend was 16⅔ per cent. The new shares offered to ordinary holders last month do not rank for the interim dividend.

Bakelite, Ltd., is to increase its authorized capital from £2,000,000 to £3,000,000 by the creation of 1,000,000 6 per cent cumulative redeemable preference shares of £1 each, to be issued as soon as the necessary resolutions have been passed on 8th November. The new capital is needed to finance increased productive capacity and the shares may be privately placed.

Telephone Properties, Ltd.—At an extraordinary meeting held on 11th October resolutions were passed increasing the capital to £1,150,000 and authorizing the issue to ordinary stockholders of three new ordinary shares for every £2 of ordinary stock held. The company's name was changed to Temple Bar Investment Trust, Ltd.

Thos. W. Ward, Ltd., report that after providing £1,215,557 for taxation, the net profit for the year to 30th June last is £1,136,972, as compared with £788,490 for the preceding year. It is proposed to place £400,000 to general reserve and to pay a final ordinary dividend of 11¼ per cent, making 15 per cent for the year. For the previous year the total distribution was 15 per cent, but the interim dividend of 5 per cent was paid before the 100 per cent scrip issue.

Babcock & Wilcox, Ltd., are paying an interim dividend of 7 per cent (unchanged).

The Engineering & Lighting Equipment Co., Ltd., has announced an interim dividend of 5 per cent on the ordinary capital of £250,000 as increased on 30th March last. For the previous year the interim dividend on the smaller capital was 15 per cent.

The Electrical Apparatus Co., Ltd.—The net profit for the year to 31st July last, subject to audit, is £150,000, as compared with £126,063 for the preceding year. Taxation absorbed £144,000. It is proposed to pay a final dividend of 15 per cent, making 22½ per cent for the year (unchanged) on increased capital.

James Howden & Co., Ltd.—The annual meeting was held on 14th October, Mr. C. W. Hume (chairman) presiding. In his circulated statement, Mr. Hume said that the year's output had been a record, the order book was good and future prospects both at home and overseas were satisfactory. Good progress had been made with the electro-precipitator and they intended to start its commercial development in the near future. Referring to atomic power production, the chairman said that they were keeping in touch with the developments and had already completed installations for the United Kingdom Atomic Energy Research Establishment.

J. & F. Stone Lighting & Radio, Ltd., report a profit for the year to 30th June last of £833,578, as compared with £753,211 for 1953-54, and after providing £400,460 for taxation, the net balance is £433,118 (against £310,511). It is proposed to pay a final dividend of 30 per cent and a bonus of 10 per cent, maintaining the distribution for the year at 50 per cent. Reserves receive £125,000 and the balance carried forward is £260,707 (against £265,701 brought in).

Glenfield & Kennedy Holdings, Ltd., is paying an interim dividend of 5 per cent (unchanged).

Reliance-Clifton Cables & Industrial Products, Ltd., is paying an interim dividend of 11 per cent on the ordinary stock (against 10 per cent).

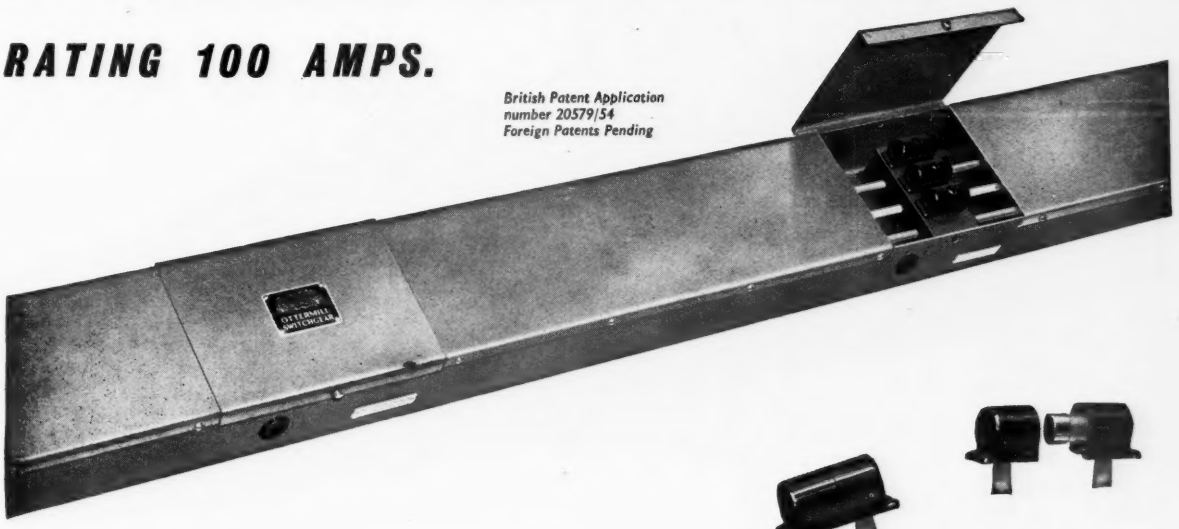
Hoover, Ltd.—The board states that sufficient opposition has been received from the "A" ordinary shareholders to prevent the proposed scheme of capital reorganization being carried

(*Continued on page* 825)

MINIATURE BUSBAR TRUNKING

RATING 100 AMPS.

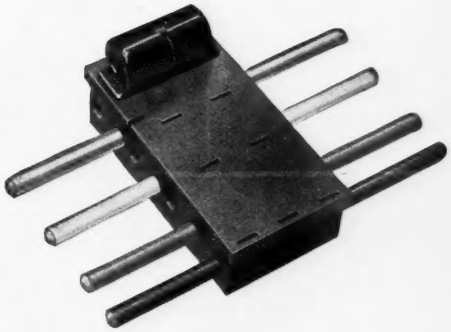
British Patent Application number 20579/54 Foreign Patents Pending



Busbar Trunking is unquestionably the best method of distributing electric power in machine shops, and wherever power is required at numerous points.

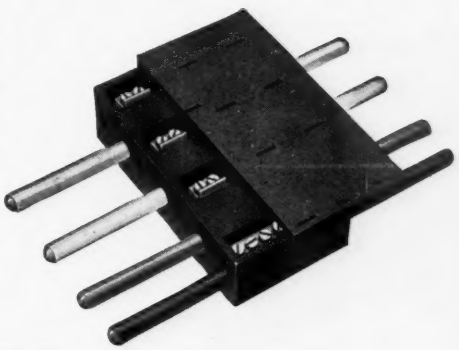
Ottermill MINIATURE Busbar Trunking has been specially designed to meet the practical requirements of the smaller installation. It is not a medium current or heavy current system scaled down.

A "take off" or "tapping position" is provided every two feet along the Busbar Trunking, and power connections can be made at these points in a matter of minutes. Each position is fully furnished with a combination fuse unit which can be made "alive" by the insertion of H.R.C. Fused Carriers. Fused tapping boxes and additional equipment are not required.

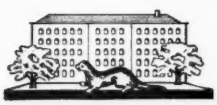


Connections from the Busbars to external load can be made in perfect safety with the Busbars "alive", for the Busbars are all insulated, and access to the outgoing terminals of the combination fuse units is barred by interlock unless all fuses are withdrawn. The Busbars of this Miniature system are rated at 100 amps., but when fed at the mid electrical point are suitable for 200 amps. continuous working load.

The Miniature Trunking system is standardized in 12 ft. and 6 ft. lengths. Accessories such as Right Angle Bends, Incoming Cable Units, etc., are equally standard.



Please write for catalogues:—
Miniature Busbar Trunking (100 amps.) leaflet MBT.971.
Busbar Trunking (200–600 amps.) catalogue BBT.971.
Cable Trunking leaflet CT.971.



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Main Works: STONHOUSE STREET, S.W.4.

Branch Works:

5/7 POCOCK STREET, S.E.1. Waterloo 4572

OFFORD STREET WORKS, N.1. North 4031

BURDETTE'S
Electrical Services

Reports and Dividends (*continued*)

out. The directors have decided to consult the larger holders of the ordinary stock and "A" ordinary shares with a view to putting forward an acceptable modified scheme. Consequently no business was transacted at the meetings held yesterday (Thursday).

New Companies

Plessey Development Co., Ltd.—Registered 1st October. Capital £100,000. To establish companies and associations for the prosecution or execution of undertakings, works, projects and enterprises of all kinds. Power is taken to carry on the business of electricians, electrical and electronic engineers and manufacturers of all kinds of electrical machinery and electrical and electronic apparatus, etc. The first directors are to be appointed by the subscribers. Solicitor: J. S. Davison, 56, Vicarage Lane, Ilford, Essex.

James' Electrical Wholesalers (Keighley), Ltd.—Registered 7th October. Capital £4,000. Directors: C. C. James and R. S. Holmes. Regd. office: 55, Sun Street, Keighley.

Winding-up Order

Tungsten Electric Co., Ltd.—An order for the compulsory winding-up of this company was made by Mr. Justice Vaisey in the Chancery Division on 10th October.

Liquidations

A. S. Wooton & Co., Ltd., radio and electrical engineers.—Winding up. Liquidator, Mr. A. T. Eaves, 47, Mosley Street, Manchester, 2, appointed 3rd October. Particulars of claims to the liquidator by 4th November.

Noble & Gregory, Ltd., electrical engineers and contractors.—Last day for receiving proofs for dividend 28th October. Liquidator, Mr. R. Betts, Government Buildings, 10, St. Mary's Square, Swansea.

Bex Electric, Ltd.—Sixth and final dividend of 9$\frac{5}{16}$d in the £, payable at the office of the liquidator, Bedford Row House, 58, Theobalds Road, London, W.C.1.

Bankruptcies

E. W. White, 5, Greenfield Road, Southmead, Bristol, electrical contractor.—Receiving order made 4th October on debtor's own petition. Public examination 2nd December at the Guildhall, Small Street, Bristol, 1.

K. M. Ashworth and **D. Revell,** trading in co-partnership as Ashworth & Revell at 265, Bradford Road, Frizinghall, Bradford, and at 120, Otley Road, Shipley, electrical contractors.—Receiving order made 6th October on debtors' own petition.

J. E. Rippin, Egglestone's Yard, Sherwood Avenue, Newark-on-Trent, electrical engineer.—Receiving order made 7th October on debtor's own petition.

S. Shaw, 133, Leeds Road, Bradford, electrical contractor.—Public examination 9th November at the County Court, Manor Row, Bradford.

M. S. Harris, Four Winds, Beech Road, Purley, Berks, electrical engineer.—Public examination 8th December at the Assize Court, Forbury, Reading.

E. Newland, 130, Grove Road, Chadwell Heath, Romford, Essex, electrical contractor.—Public examination 8th December at 102, Alexandra Road, Southend-on-Sea.

J. Hillier, 76, Whitechapel Road, London, E.1, electrical and radio dealer.—Application for discharge to be heard on 16th November at Bankruptcy Buildings, Carey Street, London, W.C.2.

W. E. Sparrow and **F. Sparrow,** carrying on business under the style of Sparrow & Co., electrical contractors, at 8, Longsmith Street, Gloucester (separate estate of W. E. Sparrow).—Application for discharge to be heard on 17th November at the Shire Hall, Gloucester.

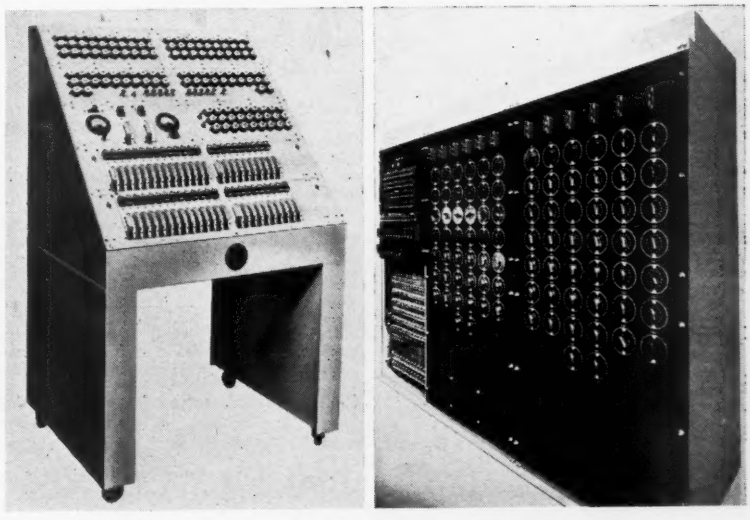
Television Lighting Control Gear

All the principal television studios recently built or under construction are installing equipment for the proper control of lighting. The Strand Electric & Engineering Co., Ltd., who are making and installing these controls, are not new to television since it was their switch and dimmer boards which operated the lighting in both studios at Alexandra Palace when the world's first regular high definition television service was inaugurated by the B.B.C. in 1936. The boards are still in use.

All Associated Rediffusion studios are fitted with compact remote control panels requiring one man only to switch and dim the 150 or so circuits in each particular studio. These control facilities have been assembled as compact desks, into which a degree of automatic control has been incorporated allowing the switchboard to "memorize" instantly various combinations of lighting, each of which can be brought into use at the touch of a button.

Dimmers have been included on all schemes, the exact proportion in relation to the actual switched circuits depending on the studio size and layout and type of production likely to be met. Some studios provide one circuit to each dimmer; others a ratio of 2 to 1 or even 4 to 1. Patching of these dimmers, as required, is carried out by cord and jack systems or by the selector switch system which actually indicates at the control desk dimmer lever the circuits patched to it at that time.

The dimmers being used by Strand Electric for T.V. are auto-transformer, resistance, electronic, or saturable reactor (choke) depending on the particular circumstances. The method of presetting commonly used for the first two is electro-mechanical. The dimmers are servo-controlled clutch-operated from a common shaft with a wide range of speed variation (2 to 45 sec dimmer travel or slower by impulse) available at the control desk. The result provides a high degree of flexibility with, however, the precise repetition of lighting intensities so important in balancing the television picture.



A Strand control desk as installed at the Wembley studios, and (right) a selector switch patching panel for use in conjunction with the desk

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 24th October

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio & Telecommunication Group. "Colour Television," by L. C. Jesty.

BRIGHTON.—Technical College, 6.30 p.m. I.E.E. Southern Graduates' & Students' Section. Chairman's address, by A. Teague.

BRISTOL. — Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Utilization Group. Visit of the chairman of the Utilization Section, D. B. Hogg.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "Design, Performance and Application of Miniature Circuit-Breakers," by H. W. Wolff and T. G. F. Atherton.

LEEDS.—24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. Chairman's address, "The Installation, the Engineer and the Local Authority," by R. R. Cooper.

LEICESTER.—E.M.E.B., Charles Street, 6 p.m. I.E.S. Leicester Centre. "Special Effects for T.V. Studio Productions," by A. M. Spooner.

NEWCASTLE-UPON-TYNE. — Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Problems of Hydro-Electric Design in Mixed Thermal-Hydro-Electric Systems," by T. G. N. Haldane and P. L. Blackstone.

STOKE-ON-TRENT. — Hanley Town Hall, Hanley, 7.15 p.m. Institution of Production Engineers, North Western Region, Stoke-on-Trent Section. "Some Interesting Details to the Engineer obtained during my recent visit to Germany," by W. R. Bailey.

Tuesday, 25th October

BANBURY. — North Oxfordshire Technical College & School of Art, Bath Road, 7.30 p.m. Institution of Production Engineers, Southern Region, Oxford Section. "Automation in the Aluminium Industry," by D. A. Ellis, followed by film.

CAMBRIDGE. — Technical College, Collier Road, 6.30 p.m. I.E.E. East Anglian Sub-Centre. "Automatic Circuit Reclosers," by G. F. Peirson, A. H. Pollard and N. Care.

CHELMSFORD. — Public Library, 7 p.m. I.E.E. London Graduates' & Students' Section, district meeting. Chairman's address, "A.c. Switchgear," by M. H. F. Collins.

COVENTRY.—Methodist Central Hall, Warwick Lane, 7 p.m. I.E.E. South Midland Students' Section. "Amplifiers for Magnetic Tape Recording," by D. I. Williams.

Coventry Electric Club. Film, "Planned for a Purpose," followed by a discussion.

EDINBURGH. — Little Theatre, Pleasance, 7.30 p.m. Edinburgh Electrical Society. "Railway Electrification," by J. A. Broughall.

MAIDSTONE.—Royal Star Hotel. A.S.E.E. Kent Branch. Annual dinner.

LEEDS.—1, Whitehall Road, 6.30 p.m. North Midland Graduates' & Students' Section. Problems evening.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement & Control Section. "An Electrostatic Particle Accelerator," by D. R. Chick and D. P. R. Petrie and "An Electrostatic Analyser for the Absolute Measurement of Proton Energies and the Establishment of Fixed Points on the High-Voltage Scale," by Dr. S. E. Hunt, D. P. R. Petrie, K. Firth and A. J. Trott.

Lighting Service Bureau, 2, Savoy Hill, 6 p.m. Illuminating Engineering Society. Report and discussion on the 1955 meeting of the International Commission on Illumination.

LUTON.—S.K.F., 7.30 p.m. Institution of Production Engineers, South Eastern Region, Luton Section. "Principles of Colour Television," by P. F. Carnt.

MANCHESTER. — The University, Dover Street, 6.15 p.m. I.E.E. North-Western Measurement & Control Group. Informal discussion on "Electrical Automatic Control," opened by Dr. J. C. West.

NOTTINGHAM.—College of Art and Crafts, 6.30 p.m. I.E.E. East Midland Centre. "The Training of the Engineer in the Mining Industry," by J. Jeffrey.

SELBY.—A.S.E.E. York Branch. Visit to British Oil and Cake Mills.

Tuesday, 25th October, to Thursday, 27th October

LONDON.—1, Birdcage Walk. Institution of Mechanical Engineers. Joint Conference on Combustion with the American Society of Mechanical Engineers.

Tuesday, 25th October, to Friday, 28th October

LONDON.—Olympia. Dairy Show.

Wednesday, 26th October

GLASGOW.—39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. Questions evening.

LIVERPOOL.—9, The Temple, Dale Street, 6 p.m. Institute of Fuel, Merseyside Sub-Section. "Some Factors Governing the Welfare of Steam Boilers and Other Pressure Plant," by F. Shapley. (Joint meeting with the Liverpool Engineering Society.)

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. Chairman's address, by L. Drucquer.

School of Hygiene & Tropical Medicine, Keppel Street, 6 p.m. British Institution of Radio Engineers, London Section. Annual general meeting, followed at 7 p.m. by "Recent Advances in Microwave Tubes," by Dr. R. Kompfner.

Manson House, Portland Place, 7 for 7.30 p.m. Institute of Welding, North London Branch. "The Part of Resistance Welding in Automation," by R. W. Ayers.

Gaumont-British Theatre, Film House, Wardour Street, 7.15 p.m. British Kinematograph Society. "Special Effects for Television and Electronic Films," by Dr. A. M. Spooner.

NOTTINGHAM. — Regent Hall, Mansfield Road, 7.30 p.m. A.S.E.E. Nottingham Branch. Haldane Regional Lecture: "The Advent of the Atomic Age," by Prof. L. S. Palmer. (Joint meeting with the Birmingham Branch.)

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Colour Television," by B. V. Somes-Charlton. (Joint meeting with the Rugby Engineering Society.)

A.S.E.E. Oxford, Reading & Districts Branch. Visit to British Thomson-Houston Co.

SCUNTHORPE.—Technical College, 7 p.m. I.E.E. Sheffield Sub-Centre. "Repairing Electrical Plant," by J. Ashmore.

SHREWSBURY.—Walker Technical College, Oakengates, 7.30 p.m. Institution of Production Engineers, Midlands Region, Shrewsbury Section. "Industrial Applications of Electrical Devices," by P. L. B. Buckley and S. L. Robinson.

Thursday, 27th October

BIRMINGHAM.—James Watt Institute, 6.30 p.m. I.E.E. South Midland Education Discussion Circle. "The Teaching of Electromagnetism," by Dr. K. J. R. Wilkinson.

NEWARK.—Robin Hood Hotel, 7.30 p.m. Institute of Industrial Supervisors, Newark Section. Presidential address, by J. B. Samson.

Friday, 28th October

BASLOW. — Devonshire Arms Hotel. A.S.E.E. Sheffield Branch. Annual dinner and dance.

BIRMINGHAM.—Regent House, St. Phillip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Display Lighting," by J. A. Barker.

Imperial Hotel, Temple Street. E.P.E.A. Midlands Division. Annual dinner and dance.

Queen's Hotel. Electrical Trades' Commercial Travellers' Association, Midlands Branch. Annual dinner.

New Inns Hotel, Handsworth. Junior Institution of Engineers, Midland Section. Annual dinner-dance.

BRISTOL.—Royal Hotel, 7 p.m. I.E.S. Bath & Bristol Centre. Architects' night. (Joint meeting with the Bristol Society of Architects.)

Grand Hotel. Incorporated Plant Engineers, Western Branch. Annual dinner.

LONDON.—Savoy Hotel, W.C.2, 6.45 for 7.15 p.m. Faraday House Old Students' Association. Annual dinner.

STAFFORD. — Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Proving the Performance of Circuit-Breakers, with particular reference to those of Large Breaking Capacity," by J. Christie, H. Leyburn and J. F. Bird and "A New Testing Station for High-Power Circuit-Breakers," by J. Christie, H. Leyburn and R. W. Fenn.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 5th November:—

LISTER BLACKSTONE. No. 741,490, Class 7. Internal-combustion engines (not for land vehicles) and parts.—R. A. Lister & Co., Ltd., Victoria Iron Works, Long Street, Dursley, Glos.

FANTOM (design). No. 741,496, Class 7. Fractional h.p. electric motors (not for land vehicles).—English Electric Co., Ltd., Queen's House, 28, Kingsway, London, W.C.2.

KEMA KEUR (design). No. 738,875. KEMA KEUR. No. 738,877, Class 9. Electrical apparatus and instruments and parts; and insulated electric wires and cables.—Naamloze Vennootschap Tot Keuring Van Electrotechnische Materialen, Arnhem, Netherlands. Address for service, c/o McKenna & Co., 12, Whitehall, London, S.W.1.

PYECO. No. 741,059, Class 9. Radio and television apparatus and parts; gramophone pickups, microphones, amplifiers and loudspeakers; and electric oscillation generators, batteries and accumulators.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

TRI-FI (design). No. 741,981, Class 9. Radio receivers, television receivers and sound reproducing apparatus. — Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

BELCLERE. No. 742,775, Class 9. Electrical apparatus and instruments and parts.—Savory & Moore, Ltd., 61, Welbeck Street, London, W.1.

BICELFLUX. No. 743,847, Class 9. Electric insulated wires and insulated metal strips.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

TAMALYSER. No. 744,481, Class 9. Measuring, indicating and recording instruments, and parts. — Television Audience Measurement, Ltd., Chantry House, Eccleston Street, London, S.W.1.

TUNSAND. No. 743,374, Class 9. Electrical and electronic apparatus and instruments; and radio and television sets.—G. F. Faulkner (Export & Import), Ltd., 40, Tonbridge Road, Maidstone, Kent.

FEDREX (design). No. 741,519, Class 10. X-ray apparatus and instruments and stands therefor; and parts.—C. Drenck, Copenhagen, Denmark. Address for service, c/o E. Kowol, 27A, Randolph Crescent, London, W.9.

MODALITE. No. 742,014, Class 11. Lighting fittings.—Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Antrim.—28th October. East Antrim Hospital Management Committee. Electrical installation in the Sir Thomas and Lady Edith Dixon Hospital, Cairndhu, Larne. 9th November. Antrim Education Committee. Electrical installation in proposed extension to Largymore Primary School, Lisburn. J. McCandless, consulting engineer, 6, Murray Street, Belfast.

Australia.—29th November. Snowy River Hydro-Electric Authority, Sydney. Isolating switches and circuit-breakers. (E.S.B. 21725/55. Ten/16084.)*

14th November. Electricity Commission of New South Wales, Sydney. Six automatic telephone exchanges. (E.S.B. 21724/55. Ten/16095.)*

Belfast.—3rd November. Northern Ireland Housing Trust. Electrical installations in 137 dwellings at Ballyclare, Co. Antrim. Offices of the Trust, 12, Hope Street.

Bingham.—2nd November. R.D.C. Electrically driven centrifugal pumps in two stations at Keyworth, near Nottingham. William Saunders & Partners, consultants to the Council, 24, Castle Gate, Newark.

Cornwall.—County Council. Electrical contractors wishing to tender for electrical services at a new junior school at Saltash should apply by 29th October. (See this issue.)

Costa Rica.—30th November. Instituto Costarricense de Electricidad, San Jose. Panels, switchboards, structures and accessories. (E.S.B. 21567/55. Ten/16046.)*

Edinburgh.—North of Scotland. Hydro-Electric Board. 11 kV main power cables and auxiliary cables at St. Fillans power station. (See this issue.)

Formosa.—4th November. Central Trust of China, Taipei. Outdoor package type substation, lighting panel board and air circuit-breaker. (E.S.B. 21329/55. Ten/16035.)* 8th November. Transformers. (E.S.B. 22027/55. Ten/16173.)*

Greece.—15th November. State Procurement Service, Ministry of Finance, Athens. X-ray diagnostic apparatus. (E.S.B. 21982/55. Ten/16109.)*

India.—25th November. Damodar Valley Corporation, Calcutta. Power circuit-breakers. (E.S.B. 21862/55. Ten/16106.)*

Kuwait.—5th November. Government Department of Electricity. 500 domestic refrigerators with spare parts. (E.S.B. 21755/55. Ten/16083.)* 12th November. 1,000 self-contained window type air conditioning units. (E.S.B. 21858/55. Ten/16082.)*

Lebanon.—24th October. Beirut Electricity Office. 15,000 kW steam turbo-alternator for Chamoun power station. (E.S.B. 16564/55. Ten/16123.)*

Middlesex.—21st November. County Council. Cables, light and plug circuits at Mogden purification works, Isleworth. (See this issue.)

Newark.—9th November. Corporation. Street lighting equipment. (See this issue.)

Newburn.—12th November. U.D.C. Street lighting equipment. (See this issue.)

New Zealand.—10th November. Post and Telegraph Department, Wellington. Contactors, motor starters, etc. (E.S.B. 21792/55. Ten/16114.)* 6th December. Telephone switchboard wire. (E.S.B. 21940/55. Ten/16135.)*

14th February. State Hydro-Electric Department, Wellington. One 2,500 kVA, 11 kV regulating transformer and earthing transformer. (E.S.B. 21950/55. Ten/16137.)* 21st February. 30,000 kVA transformer bank and spare units. (E.S.B. 21918/55. Ten/16142.)*

Pakistan.—26th October. Director General of Supply and Development, Karachi. Radio sets, electric irons, hot plates, refrigerators, cookers and washing machines. (E.S.B. 21662/55. Ten/16085.)* 10th November. Generators, diesel engines, turbine pumps, etc. (E.S.B. 21918/55. Ten/16148.)*

2nd November. Posts and Telegraphs Department, Karachi. Air conditioning equipment for Karachi exchange. (E.S.B. 21470/55. Ten/16075.)*

Plymouth.—4th November. City Council. Electrical installations in Council houses and 1,890 electric fires. (See this issue.)

Port Talbot.—12th November. Corporation. Street lighting equipment. (See this issue.)

Selby.—7th November. U.D.C. Street lighting equipment. (See this issue.)

South Africa.—9th November. Stores Department, South African Railways. H.r.c. fuse switchboards. (E.S.B. 21664/55. Ten/16072.)* 1,000 contact wire ending cones. (E.S.B. 21665/55. Ten/16073.)* 11th November. Electrical signalling lamps. (E.S.B. 22123/55. Ten/16163.)* 25th November. Electrical signalling material. (E.S.B. 22122/55. Ten/16150.)*

10th November. Union Tender and Supplies Board, Pretoria. Radio components. (E.S.B. 22136/55. Ten/16152.)* 17th November. Rectifiers. (E.S.B. 21979/55. Ten/16126.)*

Southern Rhodesia. — 28th October. Federal Tender Board, Causeway. 60,000 telephone dry cells. (E.S.B. 21723/55. Ten/16074.)*

Thornaby (Yorks).—Town Council. Electrical installations in 24 new bungalows on the Redcar Road housing estate. J. L. Watson, borough engineer, Town Hall.

Upper Witham.—3rd December. Internal Drainage Board. Land drainage pumps and electric motors, starters, etc., for two new pumping stations. J. Barnatt, engineer to the Board, 20, Orchard Street, Lincoln.

Uruguay.—23rd November. Administracion General de los Usinas Electricas y los Telefonos del Estado, Montevideo. Automatic circuit-breaker. (E.S.B. 21243/55. Ten/16076.)* 25th November. "Walkie-talkie" portable radio telephones. (E.S.B. 21757/55. Ten/16100.)* 30th November. Lampholders and lighting receptacles. Re-issue of tender No. 2329 of 1954. (E.S.B. 26408/55. Ten/11396A.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bodmin. — Corporation. Recommended. Improved lighting of the trunk road (£2,601). —G.E.C.

Burnley.—Manchester Regional Hospital Board. Recommended. New electricity distribution system at General Hospital (£33,117).—Alan E. Dent.

Carlisle.—City Council. Accepted. Electrical installation in 214 houses (£5,413) and 38 bungalows and flats (£879).—Hartley Electromotives.

Coventry.—City Council. Street lighting schemes: 150 Class "A" mercury units (£6,350), 44 Class "A" sodium units (£2,033), 28 Class "A" mercury lanterns and control gear (£485) and 58 Class "B" concrete columns (£574).—Revo Electric Co.; 475 conversion units (£1,651).—A. C. Ford; 504 sets of control gear for 80 W lamps (£1,182).—B.T.H. Co.; 29 60 W sodium lanterns and sets of control gear (£296).—Wardle Engineering Co.; 29 60 W sodium lamps and jackets (£78).—Philips Electrical.

London.—L.C.C. Electrical installation at Wenlake and Chadworth Buildings, Finsbury (£7,405).—Carr Bros. & Carr (Wandsworth).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldridge (Staffs).—Factory for Cone Automatic Machine Co.; Turriff Construction Co., Budbrook Road, Warwick.

Bedford.—Works extensions; W. H. A. Robertson & Co., Lynton Road.

Ten-storey flats at St. John's Glebe; C. H. Blakeway, borough surveyor, Newnham House, Horne Lane.

Birmingham.—Workshops, garages and stores, Rotton Park Street Depot; city engineer.

Bradford.—Three-storey building with basement comprising shops, offices and market hall; W. H. Leathem, town clerk, Town Hall.

St. Francis's R.C. Primary School, Bolton Road; T. A. Rae, Ltd., Green Close, Bullroyd Lane, Bradford, 8.

Brighton.—Factory extension (£115,000), Lower Bevendean estate; Rice & Son, Ltd., 23, Gloucester Place.

Bristol. — Factory, Brislington estate; Schweppes, Ltd., 1, Connaught Place, London, W.2.

Burnley.—Chest clinic, Marsden Hospital; M. & R. Clegg, Ltd., Bull Street.

Cardiff.—Houses (176), Llanrumney; city surveyor, City Hall.

Coventry.—Aged persons' home at Stoke Aldermoor and Willenhall sites; city architect.

Houses (300), Stonebridge Highway; Robinson, Osborne & Moules, surveyors, 16, Warwick Row.

Croydon.—Block of offices to house nine corporation departments in Barclay Road; E. Taberner, town clerk, Town Hall.

Dawley.—Proposed factory, Stirchley; Allied Ironfounders, Ltd., 28, Brook Street, London, W.1.

Glasgow.—Houses (1,100), Blairdardie South; John Lawrence (Glasgow), Ltd., 137, West Regent Street.

Harlow.—Factory, Western industrial area; Kingsgate (Clothing Productions), Ltd., 29, Dingley Place, London, E.C.1.

Hatch End.—Grammar school for boys; Middlesex county architect, 10, Great George Street, London, S.W.1.

Kidderminster.—Modernization and rebuilding scheme (about £290,000); Carpet Manufacturing Co., Ltd., New Road.

Lytham St. Annes.—Houses (58) and flats (32), Smithy Lane; Hardmans Builders (Kirkham), Ltd.

Manchester.—Presbyterian church at Oatlands Road, Wythenshawe; T. Reive, architect, 7, Parsonage Road, Heaton Moor, Manchester.

Market Harborough.—Shopping centre, Southern estate; Council's architect.

Penzance.—Houses (50), Newlyn and Princess Royal estate; borough surveyor, Municipal Buildings.

Portsmouth.—Depot and offices, off Southampton Road; Eldorado Ice Cream Co., Ltd., 64, Stamford Street, London, S.E.1.

Works, Western Road area; S. E. B. Upholstery (Portsmouth), Ltd., 35, Butcher Street, Portsea.

Rotherham.—Extensions to factory, Brinsworth, for British Oxygen Co., Ltd.; Demolition & Construction Co., Ltd., 3 St. James's Square, London, S.W.1.

Scarborough.—Methodist church, Eastfield estate; T. L. Chapman & Son, Ltd., 19, Auborough Street.

Sheffield.—Factory, Archer Road, Millhouses, for Laycock Engineering Co., Ltd.; J. W. Beaumont & Sons, architects, 13, Collegiate Crescent, Sheffield, 10.

Sligo (Eire).—Factory for the Sligo Spinning Co., Ltd.; Thomas C. Whelan, quantity surveyor, National Bank Chambers, 1 and 2, Cavendish Row, Dublin, C.16.

Slough.—Office block; Imperial Chemical Industries, Ltd., Wexham Road.

Smethwick.—Health centre, Holly Lane; S. J. Smith & Co. (Bidford), Ltd., Smith Road, Wednesbury.

Solihull.—Assembly hall block of new civic centre; E. B. Webber, architect, 39, Gordon Square, London, W.C.1.

Southampton.—Factory; Skinners (Redbridge), Ltd., 30, Coniston Road.

South Broomhill.—Clinic and ambulance depot (£14,000); county architect, County Hall, Newcastle.

South Shields.—Nursery schools in Summerhill Road, Bamburgh Grove, Westmorland Road and Grotto Road, infants' school in Highfield Road and final instalment of the Mortimer Road County Secondary School; John Reid, borough engineer.

Sunderland.—Modernization of works (£400,000); George Clark (Sunderland), Ltd., Southwick Engine Works.

Tadworth (Surrey).—Office block at St. Monica's, Kingswood, for Legal & General Assurance Society, Ltd.; R. Fielding, architect, Aldwych House, Aldwych, London, W.C.2.

Thornbury.—Flats (47), at Gloucester Road, for R.D.C.; Rainger, Rogers & Smithson, architects, Glenmore Lodge, Wellington Square, Cheltenham.

Thorne (Yorks).—Houses (approx. 100), during coming year; R.D.C. architect.

Tow Law (Co. Durham).—Houses (28), North Cottages site; U.D.C. surveyor.

Tynemouth.—Secondary technical school, Preston Village; borough surveyor.

Walsall.—Printing works on site at The Square; Walsall Observer, Ltd., Bridge Street.

Wallsend.—R.C. infants' school at Willington Quay (£51,000); R. Burke, architect, Lambton Road, Newcastle-on-Tyne.

Watton (Norfolk).—Secondary modern school (£141,904); chief education officer, Stracey Road, Norwich.

Welwyn Garden City.—Works extensions; Ardath Tobacco Co., Ltd., Broadwater Road.

West Bromwich.—Extensions to works, Walsall Street, for Joseph Wones, Ltd.; John Dallow & Sons, Ltd., 4, High Street.

Whittlesey.—Private estate of 165 dwellings and shops proposed in New Road; Reuben Rose (Properties), Ltd., Whittlesey, Cambs.

Wolverhampton.—Bus station, Railway Drive; Greenly Bros., Penn Road.

Old people's home at Showell Circus, Low Hill (£33,000); J. Brock Allon, town clerk, Town Hall.

Worcestershire. — Longlands Secondary School; A. H. Guest, Ltd., Stourbridge, Worcs. Hasbury Farm C.P. School; Wm. Cooper & Son, Ltd., West Street, Blackheath, Birmingham.

Wrexham.—Houses, Tanydre (26), and Garden Road (24); borough surveyor, 31, Chester Street.

York.—Skelton C.P. School; Sorrell & Sons, Ltd., Main Street, Heworth, York.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 23rd November from the Patent Office, 25, Southampton Buildings, W.C.2.

1951

3270. Mullard Radio Valve Co., Ltd.—Television receivers. 8th February, 1952. (740881.)

15242. Yorkshire Switchgear & Engineering Co., Ltd., and Caton, G.—Electric circuit-breakers having arc-rupturing arrangements. 27th June, 1952. (740883.)

18853. Philips Electrical Industries, Ltd.—Fluid-flow controlled electric switches. 7th August, 1952. (740963.)

26306. British Thomson-Houston Co., Ltd.—Carbon holders for electric arc lamps. 19th September, 1952. (741045.)

1952

8132. British Thomson-Houston Co., Ltd.—Silicone rubbers. 31st March, 1952. (740968.)

14581. Fries, G., and Vredenburg-Inglesby, J. C.—Electronic cameras for recording electron images. 10th June, 1953. (740970.)

18007. General Electric Co., Ltd., and Thompson, W. G.—Electric convertor arrangements. 16th July, 1953. (740895.)

18397. General Electric Co., Ltd., and Thompson, W. G.—Electric rail traction equipment. 16th July, 1953. (740896.)

18975. National Research Development Corporation.—Variable electrical resistances or potentiometers. 15th October, 1953. (740810.)

25049. Russell, R. J.—Electrical socket connector clip. 17th December, 1954. (740977.)

25660. Parker & Osborn (Plate & Sheet Glass Merchants), Ltd., and Osborn, C.—Reflectors for tubular electric lamps. 13th January, 1954. (741056.)

26236. Westinghouse Brake & Signal Co., Ltd., and Everett, D. B.—Electromagnetic relays. 14th September, 1953. (741057.)

29276. Johnstone, D. M.—Electronic d.c. electric generating apparatus. 17th November, 1953. (741058.)

31997. British Thomson-Houston Co., Ltd.—Electric motor control systems. 15th December, 1953. (741060.)

33117. Metropolitan-Vickers Electrical Co., Ltd.—Electric motor control systems. 18th December, 1953. (740816.)

1953

1138. Chapman, G. A.—Electric fires. 13th April, 1954. (740907.)

1349. Licentia Patent-Verwaltungs Ges.—Dry-plate rectifier assembly. 16th January, 1953. (741084.)

1362. General Electric Co., Ltd.—Radio communication systems. 13th January, 1954. (740822.)

1912. Landis & Gyr Akt.-Ges.—Construction of brake magnets suitable for electricity meters. 22nd January, 1953. (740908.)

7671. Wayne Kerr Laboratories, Ltd., and Cullen, A. L.—Microwave wattmeters. 19th March, 1954. (740915.)

12264. Simon-Carves, Ltd.—Electrostatic precipitators. 28th July, 1954. (740919.)

14015. Standard Telephones & Cables, Ltd.—Electric discharge devices. 19th May, 1953. (740838.)

15557. General Electric Co.—Dynamo-electric machines. 5th June, 1953. (740839.)

15985. Electric cutouts. 10th June, 1953. (740841.)

16778. Crane Packing Co.—Electric control for motors. 17th June, 1953. (741006.)

20634. Melbourn, W. F., Beswick, D. G. E., and Beswick, K. E.—Electric fuses and fuseholders. 22nd June, 1954. (741117.)

21854. Standard Telephones & Cables, Ltd.—Means and method of supporting helical conductors. 7th August, 1953. (740852.)

21863. Philips Electrical Industries, Ltd.—Electric capacitors. 7th August, 1953. (741019.)

22037. General Electric Co., Ltd., Baker, B. O., Wilkinson, K. H., and Wright, D. A.—Thermionic and secondary emission cathodes. 22nd July, 1954. (741020.)

22287. Demag-Zug Ges.—Electric hoist. 12th August, 1953. (741063.)

22374. Lodge-Cottrell, Ltd.—Apparatus for controlling the operation of electrostatic precipitators. 28th July, 1954. (740854.)

23153. British Insulated Callender's Cables, Ltd.—Termination for an electric cable of the oil-filled type. 20th August, 1954. (741066.)

23746. Telefonaktiebolaget L. M. Ericsson.—Automatic telephone exchanges. 27th August, 1953. (740876.)

24507. Philips Electrical Industries, Ltd.—Circuits for synchronizing sawtooth oscillators. 4th September, 1953. (740856.)

24937. Steatite & Porcelain Products, Ltd.—High voltage insulators. 3rd September, 1954. (740938.)

27876. Escher Wyss Akt.-Ges.—Thermal turbines. 9th October, 1953. (740944.)

31568. Bailey Meters & Controls, Ltd.—Apparatus for the detection of faults in measuring systems including electronic means. 13th November, 1953. (741033.)

32275. Soc. Francaise Radio-Electrique.—Radio transmitters operating with independent side bands. 20th November, 1953. (740871.)

32301. Landis & Gyr Akt.-Ges.—Relay for receiving electrical impulses of different frequency superposed on a heavy current network. 20th November, 1953. (740954.)

32725. Philips Electrical Industries, Ltd.—Circuit arrangements for use in telecinematograph transmitters. 25th November, 1953. (740873.)

32994. Western Electric Co., Inc.—Circuits for effecting temperature compensation of thermistors. 27th November, 1953. (740874.)

33518. Communications Patents, Ltd.—Electrical apparatus for generating non-linear functions. 2nd December, 1953. (740956.)

34350. Simon, Ltd., H.—Conveyance of powdered or finely divided materials by rotary pumps. 24th November, 1954. (740866.)

34432. Emag Elektrizitats-Ges.—Mechanical or commutator rectifiers. 10th December, 1953. (740957.)

34594. Telefonaktiebolaget L. M. Ericsson.—Contact spring groups for electrical connecting apparatus. 11th December, 1953. (741037.)

35834. Electric & Musical Industries, Ltd.—Electric motors and flywheels adapted to be driven thereby. 22nd December, 1954. (741038.)

I.E.S. Liverpool Centre

"Research Review" was the title of the chairman's address, given by Mr. G. L. Butler, Liverpool manager, G.E.C., at the opening meeting of the session of the Illuminating Engineering Society's Liverpool Centre on 11th October. The induction of Mr. Butler into the chair was by Mr. G. W. A. Illingworth, the retiring chairman.